

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 10

Sacramento, April, 1924

Number 2



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SCIENTIFIC INVESTIGATION BY THE CALIFORNIA FISH AND GAME COMMISSION.

By HAROLD C. BRYANT.

A glance at the biennial reports of the California Fish and Game Commission will show that from its beginning—and it appears to be one of the oldest of the state fish and game commissions—interest has been taken in scientific research. Early reports contain articles by such eminent scientists as Mr. Cloudsley Rutter, W. M. Lockington, Dr. David Starr Jordan, and Carl H. Eigenmann. At the present time a number of university scientists are engaged to work on special problems, in addition to a staff of experts regularly employed to carry on investigations. In fact, the Fish and Game Commission of California has made

a consistent effort to obtain accurate first-hand information relative to the present status and life histories of the game and fish of the state.

One of the first reports of definite scientific investigation by employees, is contained in the biennial report for 1897-8, wherein N. B. Scofield^a records his observations on the movements of the young of the steelhead trout, and on the rate of growth of the quinnat salmon.

In 1910-1911 various additional lines of research work were undertaken, and several scientists definitely employed to carry out investigations on salmon, crabs, edible clams, mollusks, and the spiny lobster; also on the economic value of certain nongame birds. The following introductory paragraph was used in a statement by the Commissioners (Bull. No. 1, Aug. 1911), outlining the proposed investigation:

We believe that, notwithstanding the notable success that has already followed the introduction and the acclimatization of new food and game fishes in the waters of this state, as well as the propagation of our native fishes, much can yet be accomplished; that our waters may be made to produce even more abundantly; for, notwithstanding that this Commission has been in existence for forty years and has accomplished greater results than any similar commission in the United States, very little attention has been directed to a study of the life and habits of any of our food fishes. To intelligently conserve and increase our aquatic food supply it is essential to be conversant with the life, habits, food, abundance and the principal enemies. Until we know the time and place where our food fishes propagate, the waters frequented by their young, and the conditions essential for successful development, we can not proceed intelligently. And we regret to say that at the present time, the Commission is not in possession of positive information of this character. To obtain such knowledge, we have, during the past six months, begun a systematic and scientific investigation of the life of our salmon, trout, crabs, and clams. For this work we have been enabled to enlist the services of some of the well known scientific men from our two great universities.

SALMON INVESTIGATIONS.

From the founding of the Commission until about 1914, the salmon industry was by far the most important fishing industry of California and problems connected therewith most needed solution. Attempts were first made to solve some of the problems connected with the life history of the salmon, about the year 1897. The United States Bureau of Fisheries in that year sent A. B. Alexander to Marin County to determine how long young salmon stay in the streams. This work, started by the Federal Bureau, was finally finished by the California Fish and Game Commission, which sent Mr. N. B. Scofield, one of its employees, to take the place of Mr. Alexander when the latter gentleman was recalled to the fisheries steamer "Albatross." The following year, by a cooperative arrangement, further investigations of the life history of the quinnat salmon were conducted by Cloudsley Rutter for the United States Bureau of Fisheries, and by N. B. Scofield for the California Fish and Game Commission. Splendid results were obtained, and the account of the life history as then worked out has stood the test of time.^b

^a Scofield, N. B., 1900. (a) Report on the planting of quinnat salmon fry in the short coast streams of Marin County, California, pp. 49-62, 3 pls. (b) Notes on the movements of the young of the steelhead trout in Marin County streams, pp. 63-65. (c) Notes on an investigation of the movement and rate of growth of the quinnat salmon fry in the Sacramento River, pp. 66-71. Bienn. Rept. Bd. of Fish Commsrs. of the State of California for the years 1897-1898, 75 pp., 3 pls., 3 figs.

^b Rutter, Cloudsley, 1902. Studies in the natural history of the Sacramento salmon. Seventeenth Bienn. Rept. of State Bd. of Fish Commsrs. of the State of California for the years 1901-1902, pp. 64-76, 1 pl.
1904. Artificial propagation of salmon in the Sacramento River, with addenda by Commissioners. Bienn. Rept. of the State Bd. of Fish Commsrs. of the State of California for the years 1904-1906, pp. 93-97.

In 1911, Dr. C. H. Gilbert of Stanford University, was retained to continue investigations on the salmon which would disclose the conditions confronting young salmon during their seaward migration.^a In all, 100,000 salmon fry were marked in order to determine: (1) The movements of fish of known age, in the river, the bay and the ocean; (2) what proportion of the salmon run is dependent on artificial and what proportion on natural spawning; (3) the relative advantage of liberating salmon fry at the headwaters of the Sacramento, near Sisson, and on the lower river, in the vicinity of San Francisco Bay. Unfortunately, but few marked fish were recovered and the results were not outstanding.

In more recent investigations, the Department of Commercial Fisheries has made an attempt to solve such problems as "the composition or source of origin of the schools of salmon upon which the sea fishing draws, of the movements, source of food, and other facts relating to the ocean life of salmon, of the location and extent of spawning grounds, the migrations of adults and young, and methods of introduction and distribution which will bring the best results to artificial propagation.

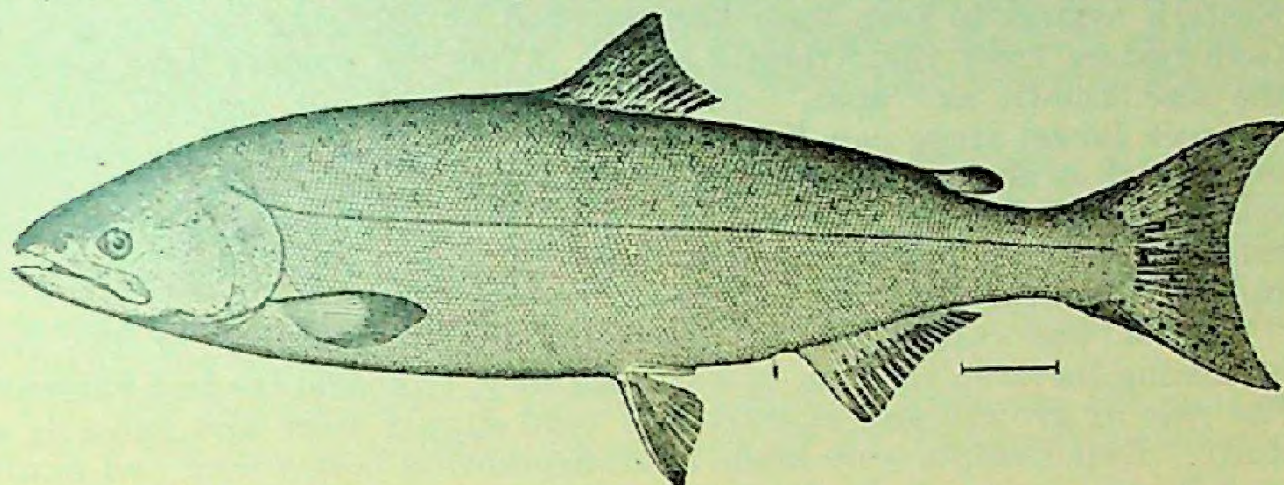


FIG. 14. Quinnet salmon, the life history of which was brought to the knowledge of the world through scientific investigations instituted by the California Fish and Game Commission.

Facts relating to these questions can only be gained through patient observation and carefully planned experimentation."

Salmon investigation work is now in charge of Dr. J. O. Snyder of Stanford University, who is exceptionally well qualified to carry on this line of work. Under his direction, marking experiments were carried out in 1917, 1918 and 1919,^b from which only partial results have been thus far obtained.

Direct evidence on the rate of growth of salmon of known age, and on the sea range of Sacramento River fish, has been made available from the study of marked fish secured in 1920.^c

^aScofield, N. B., 1913. A general report on a quinnat salmon investigation carried on during the spring and summer of 1911. Cal. Fish and Game Comm. Fish Bull. 1, pp. 35-41.

1913. The towing of salmon and steelhead fry from Sacramento to the sea in a "live car." *Ibid.* pp. 16-17.

^bScofield, W. L., 1920. King salmon marking experiment at Klamath River. 1919. Cal. Fish and Game, 6, pp. 101-104.

^cSnyder, J. O., 1921. Three California marked salmon recovered. Cal. Fish and Game, 7, pp. 1-6.

1922. The return of marked king salmon grilse. Cal. Fish and Game, 8, pp. 102-107, 3 figs., 6 pls.

1923. A second report on the return of king salmon marked in 1919, in Klamath River. Cal. Fish and Game, 9, pp. 1-9, 3 pls., 1 fig. in text.

1924. Young salmon taken at sea. Cal. Fish and Game; 10, pp. 62-64.

Snyder, J. O., and Scofield, Eugene C., 1924. An experiment relating to the homing instinct of king salmon. Cal. Fish and Game, 10, pp. 9-17, 7 figs.

It is expected that additional marked fish will be secured in the next few years.

CRAB INVESTIGATIONS.

The study of the life, abundance and the conditions most favorable to the maintenance of the edible crab (*Cancer magister*) was begun under the auspices of the Board in October of 1910. The work was done by F. W. Weymouth of Stanford University, whose findings resulted in added protection being given the edible crab.^a At the time this investigation was instituted, little was known as to where or when these crabs propagate, or of the life of their young.

OYSTER INVESTIGATIONS.

"During 1920 Dr. Harold Heath was employed on investigations relative to the propagation of the native California oyster. The larger Eastern oyster has never yielded to efforts to propagate it in this state, for the principal reason that our waters during its spawning season are entirely too cold. It has been necessary, therefore, for the growers of Eastern oysters to keep their beds stocked by bringing out the spat or seed oysters from the Atlantic coast. After the oysters have reached the size known as "spat," they will thrive in our waters, but the younger larval stage can live only within a narrow range of temperature which is above that reached by the water in any of our bays where oyster raising has been tried. Our smaller native oyster, on the other hand, propagates within a comparatively wide range of temperature and breeds naturally from San Diego Bay to Alaska.

"Work was carried on to determine the distribution of the free swimming larvæ in relation to water salinity, temperature and currents. The rate of growth and character of food supply were also subjects of study. Experiments were made in transplanting both young and adults to different parts of the bay to determine how much of a change in salinity or temperature they can withstand." (Cal. Fish and Game Comm. Twenty-sixth Bien. Rept., 1921, pp. 63-64.)

FISH PRESERVATION LABORATORY.

During 1920 and 1921 the California Fish and Game Commission, in order to save to the state the Fish Preservation Laboratory maintained by the United States Bureau of Fisheries at San Pedro, and to complete certain fish canning experiments, furnished financial support for this laboratory, the bureau finding itself with no funds to carry on the work. The bureau continued to direct the work, but the state, in order to get due credit, appeared as the operator and published preliminary reports of the work.

INVESTIGATIONS ON MARINE FISHES.

Another research problem subsidized by the California Fish and Game Commission was work on various families of marine fishes, by

^a Weymouth, F. W., 1913. Investigation of the life history of the edible crab, *Cancer magister*. Cal. Fish and Game Comm. Fish Bull. 1, pp. 29-34.
1920. The Pacific edible crab and its near relatives. Cal. Fish and Game, 6, pp. 7-10, 4 figs.

Professor Edwin C. Starks of Stanford University.^a The cost of the numerous drawings and the necessary stenographic work required for the useful articles published, was assumed by the Commission. A key to the families of marine fishes published by the same author, has been widely used by students at Stanford University and the University of California, as well as by other persons seeking a means of identifying marine fishes.^b

Mention should be made of numerous experiments in the propagation of fish at the state hatcheries and of attempts to control bacteria, fungus and ectoparasites of trout and salmon. The large annual output from the hatcheries demonstrates that numerous problems along this line have been successfully solved. Results of experiments on the hatching of striped bass, undertaken by the Commission, were largely negative.^c In 1913 and 1914, scientific investigation of stream pollution was begun, but the results have not appeared in print.

With the formation of the Department of Commercial Fisheries there began a continued study of the life histories and habits of marine fishes. In 1917, Mr. W. F. Thompson was employed to undertake an investigation of the albacore, later being placed in charge of the fully equipped State Fisheries Laboratory, built in 1921, where four men are employed to continue scientific investigation.

The fishery investigations modeled after those of Scotland, are unique in this country. Special endeavor is being made to keep them continuous in order that evidence on the actual abundance and the natural fluctuations will be obtainable. The legal backing for the securing of statistics on the annual catch is also unique and should be instrumental in furnishing unusually dependable data.

The aims of the laboratory and the outstanding problems, the solution of which has been undertaken, are outlined by Mr. Thompson as follows:

Scientific Work of the Department of Commercial Fisheries.

For the proper care of the marine fisheries of the State of California, which are the property of the state, we have in mind a permanent, securely based, and useful program, for which time and continuity of purpose are essential. This program is founded upon as critical a study as we have been able to make of the investigations of European and American governments, and it aims to substitute definite purpose for random natural history observation in our fishery work.

We believe that such a definite program, based upon accurate knowledge, will lead us far, and that in our hands as state authorities rests a legal control over the fisheries which places great responsibilities and great opportunities for service upon us.

- ^a Starks, E. C., 1917. The sharks of California. Cal. Fish and Game, 3, 8 pp., 13 figs.
 1918a. The skates and rays of California, with an account of the rat fish. *Ibid.*, 4, pp. 1-15, 18 figs.
 1918b. The herrings and herring-like fishes of California. *Ibid.*, 4, pp. 58-65, 9 figs.
 1918c. The mackerel and mackerel-like fishes of California. *Ibid.*, 4, pp. 118-129, 12 figs.
 1918d. The flat fishes of California. *Ibid.*, 4, pp. 161-179, 22 figs.
 1919a. The fishes of the croaker family (Sciaenidae) of California. *Ibid.*, 5, pp. 13-20, 8 figs.
 1919. The basses and bass-like fishes of California (families Serranidae, Haemulidae and Kyphosidae. *Ibid.*, 5, pp. 59-68, 9 figs.
^b 1921. A key to the families of marine fishes of the west coast. Cal. Fish and Game Comm. Fish Bull. 5, 16 pp., 4 figs.
^c Scofield, N. E., and Coleman, G. A., 1910. Notes on spawning and hatching of striped bass eggs at Boulder Island Hatchery. Bienn. Rept. Fish and Game Comm. of California for the years 1909-1910, pp. 109-117, 3 figs.

The Problem.

There is a fundamental difference between research upon agricultural problems and that upon the fisheries. The sources of supply of agricultural products are in large degree safeguarded from extinction, and the supply is increased or decreased according to the demand. But the source of supply for the great commercial fisheries is dependent upon natural conditions which do not respond to demand, and are not, so far as we know, elastic. As a result, the fisheries are subject to depletion from overfishing, and to great, though little understood, natural fluctuations. It is therefore inevitable that while in the case of agricultural products the most attention is given to methods of utilization and exploitation, the study of the available supply and its fluctuations should occupy most attention in the fisheries. The general and marked depletion of migratory fishes such as the salmon, together with that of our Pacific coast halibut, and the plain overfishing of various species in the waters of the North Sea, have been real object lessons to fishery men. Our program is, because of such reasons, based on the necessity of conservation and upon the need for governmental vigilance to permit the free expansion of the fisheries.^a It requires, because of its nature, the support of farseeing and unselfish men.

The first requisite for competent judgment as to the condition of a fishery is knowledge of the relative abundance from year to year of the species concerned, as shown by the results of the commercial catch.^b Statistics based upon estimates, upon volunteered information, and upon what records may happen to be kept by the trade are largely meaningless and susceptible to radical alteration by the bias or carelessness of the collector, as well as the diverse and unreliable sources of his information. Unhappily, the figures usually given are of this sort. And it is fortunate that it is within the power of the State of California to enforce the gathering of adequate and continuous statistics.

This scientific collection of statistics is the starting point and the foundation for our further investigations. The interpretation of its results is the duty of the biologists engaged by the Commission; for the great fluctuations in abundance of fish which it may show must be analyzed and their true nature discovered. Such natural fluctuations are very likely to be mistaken for depletion from overfishing; or, perhaps if of opposite trend, as a contradiction of any theory of overfishing, when they are in truth, as we have said, due to natural causes, and depletion may exist despite their temporary obliteration of its evidence. We must as a consequence develop and utilize those biological criteria which seem to distinguish depletion. The biological knowledge necessary for the use and formulation of such criteria includes the determination of age, the discovery of migrations, and of the correlation of abundance with natural physical conditions, as well as other facts. It is not exceeding the reasonable to hope that we shall be able to give warning when depletion is occurring—and indeed, unless a degree of confidence can be placed in the competency of our work, the exploitation of our fisheries may not proceed freely, nor may freedom be had from the constant fear of ruthless exploitation.

We have in mind, in addition, the need of legislators for competent data upon which measures of regulation may be based. The imposition of arbitrary and reckless restrictions should be ended by the acquisition of proper knowledge as soon as possible. At present many of our fishery laws are frankly untenable from a scientific standpoint save in so far as they actually operate to reduce the take.

In thus accepting conservation as a major policy, because of its dependence upon the legal powers of the state, we have not been oblivious of the fact that our work for that purpose has a very definite bearing on some of the greatest problems of exploitation. As an example, the abundance of fish is subject to great natural fluctuations beyond the present control of man. The returns from the fisheries vary greatly from day to day, from season to season, and from year to year. The resultant waste is an exaggerated case of the same kind which the electrical engineer meets when he is faced with the "peak" load, or maximum use of electricity during a short period each day. Just as apparatus must be available to carry this "peak" load, so must the fish canner or dealer maintain the machinery and organization for brief periods of maximum supply and longer ones of scarcity, as well as variations in demand which are disconcerting. The meat packer, their rival, need not do this. The under-

^a Thompson, W. F., 1919. The conservation of our fisheries. Cal. Fish and Game, 5, pp. 49-59, 4 figs.

^b 1919. The scientific investigation of marine fisheries as related to the work of the Fish and Game Commission in southern California. Cal. Fish and Game Comm. Fish Bull. 2, 27 pp., 4 figs.

standing of these fluctuations, so that regularly recurring ones may be expected, others foretold, and provision made to meet or avoid them, is without doubt one of the most important and most neglected functions of government scientists. And study of depletion necessitates just such an understanding of these great changes as will serve the industry.

Laws Under Which the Work Is Done.

In order that proper care should be taken of the fisheries, the legislature of the State of California passed the following law in the year 1919:

SECTION 1. It shall be the duty of the fish and game commission to gather data of the commercial fisheries and to prepare the data so as to show the real abundance of the most important commercial fishes; to make such investigations of the biology of the various species of fish as will guide in the collection and preparation of the statistical information necessary to determine evidence of overfishing; to make such investigations as will bring to light as soon as possible those evidences of overfishing as are shown by changes in the age groups of any variety of fish; to determine what measures may be advisable to conserve any fishery, or to enlarge and assist any fishery where that may be done without danger to the supply.

Further sections specify the machinery for the collection of these data.

Financial Support for Program.

The work undertaken by the Fish and Game Commission upon the commercial fisheries of the state is fortunate in that there is specific provision made by law for its support. The following law was enacted by the legislature of 1917:

SEC. 8. All moneys collected from the sale of licenses and from the privilege tax on fish, as herein provided, shall be paid to the fish and game commissioners ----- and shall be expended on conservation work for the benefit of the commercial fishing industries within the districts from which the revenues are derived.

A license to operate is required of every one catching or dealing in fish, and a privilege tax of two and a half cents per hundred pounds is assessed against all fish taken for canning purposes, under the terms of this act. In the case of sardines, this tax amounts to between a quarter and a half of one per cent of the wholesale value of the packed product.

Present Status of Program.

As is specified by the law just quoted above, every commercial transaction involving the first sale of fish is accompanied by the giving of a receipt by the buyer upon a form issued by the Fish and Game Commission, and of this receipt one copy is returned to the Commission, and another kept by the dealer. We have, therefore, actual records of all fish taken for profit, according to boat and day. The unique system has been most successful in its operation for the last three years, avoiding what we now know were widely erroneous estimates in statistics; while the fresh fish dealer has frequently for the first time a record of his own dealings.

The results obtained have continuity, and are in such detail that market conditions, changes in apparatus or fishing fleet, etc., may be readily discounted. So it will be possible to segregate the effects of scarcity of fish from the effects of those economic changes which alter the total yield. This appears necessary from the experience of fishery investigators in the North Sea. It will be feasible, for instance, to determine the yield from year to year of the same vessel for all parts of the season. We do, in fact, feel confident that there will be available for the first time in America, a relatively accurate and sensitive record of the abundance of fish in the ocean, when studied in connection with biological facts.

Such a record is, we would emphasize, one of the fundamental needs of any program of conservation, and the duty of the state governments to obtain such statistics should be plain, for in their hands alone rests the legal power to collect them, and the legal power to act upon their indications. It is sincerely to be hoped that similar systems will in course of time be used by other states; and we shall regard it as one of the greatest of our contributions if we can demonstrate the possibility of obtaining adequate statistics. The work is, indeed, in itself a scientific investigation of the first magnitude and the greatest significance.

The State Fisheries Laboratory.

For the interpretation of these data the Commission has founded the California State Fisheries Laboratory, a concrete building, at East San Pedro, where the statistics will be kept and analyzed by biologists. The statistics upon which they will base their findings in part will be collected as routine work of other men in the Department of Commercial Fisheries, and will accumulate under the care of the laboratory. But the facts upon which any interpretation of these must be based, such as the discovery of the rates of growth of the fishes concerned, their breeding habits, migrations, and the effect of external conditions upon them, are proper subjects for research by scientists of the staff of the laboratory, with their principal objectives the nature of the natural fluctuations in abundance and the effects of over-fishing upon the composition of the fish population.

For this work it has not been possible to find men already trained. It has therefore been necessary to employ graduates and students of universities and give them the requisite training. Although such a policy has curtailed the initial production of the laboratory, it has resulted in the formation of a small research staff thoroughly in sympathy with the ends desired.

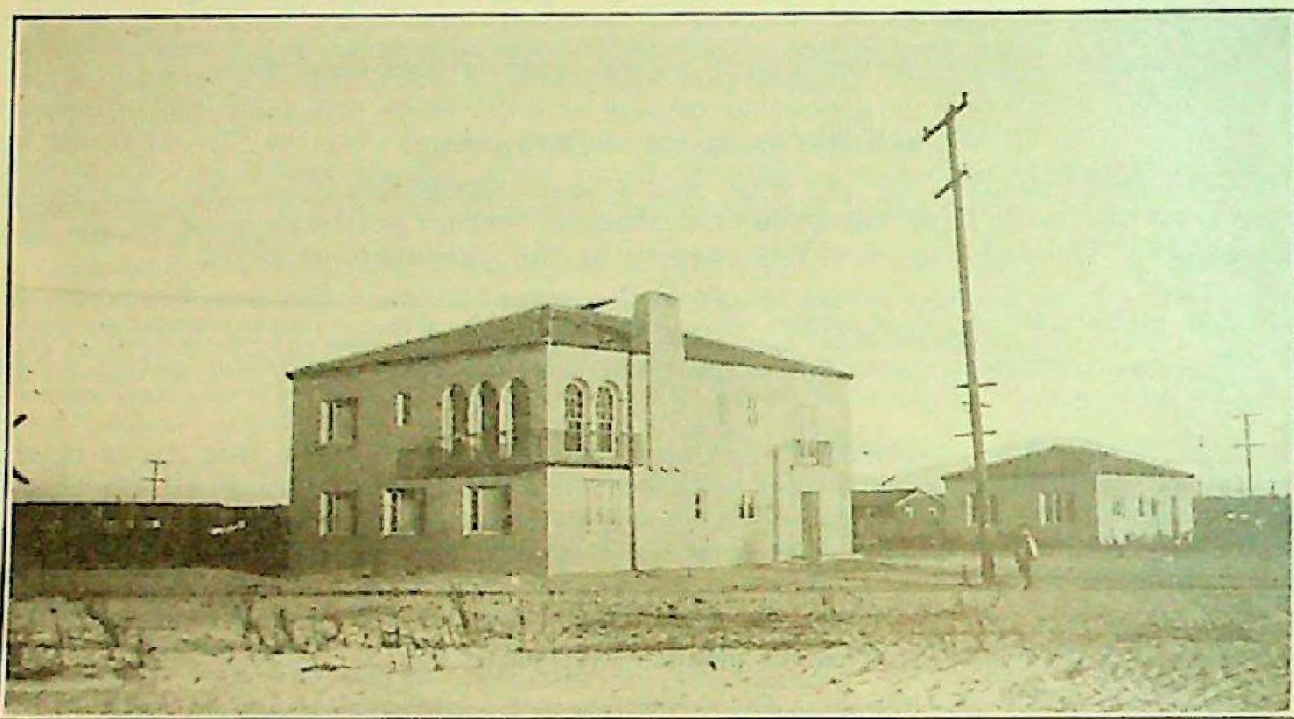


FIG 15. The State Fisheries Laboratory. Important research on the commercial fisheries of the state by a staff of scientists is in progress here.

Investigations of the Albacore.

The albacore fishery is second in importance to that for the sardine in California, and previous to the last few years was the most important. Work was therefore commenced upon its problems when the program was first started. A decline in production per boat was at once found, but the work on the age and rate of growth demonstrated that this decline commenced before the strain of the fishery could have been felt. A search for its causes has disclosed a close correlation between the catch and meteorological conditions which may provide an adequate explanation.^a But some anxiety is now felt because, despite the recovery of the fishery from the decline mentioned, there is not a complete return of the former abundance and the older age classes have become very scarce. The necessity for continued vigilance is plain, for overfishing is entirely possible in this highly concentrated fishery, which is carried on over a restricted area of coast. The scientific facts utilized in drawing these conclusions are in preparation for publication, and have proved to be of great biological interest, as well as practical value, especially those bearing upon age and migrations.

^a Thompson, W. F., 1917. Temperature and the albacore. Cal. Fish and Game, 3, pp. 153-159, 3 figs.

Investigation of the Sardine.

Unlike the albacore fishery, the sardine canning industry is as yet confined to but a small part of the total range of the species, and no signs have yet been discovered of overfishing or of a decline in abundance. But that such a decline may not occur and escape our attention, far more work is required than is the case in the albacore fishery, in order that the biological and statistical criteria may be plain.^a In addition, the natural fluctuations in the sardine fishery are great, and little understood, so that work upon them is important. The fundamental bases for scientific investigations of this species have had to be revised and tested statistically, with surprising results, and publication upon that subject may be expected in the near future. The early rate of growth is also being studied, and tentative conclusions have been reached. These, too, will receive publication shortly.

Investigation of the Grunion.

Upon this interesting species, of very considerable interest to sportsmen, fresh fish market men, and to scientists, a study of the spawning habits and migrations has been made and published as Fish Bulletin No. 3.^b A description and explanation of the very strange and wonderful habits of this little fish is given.

Investigation of the Clams.

Under the auspices of the laboratory, Professor Weymouth of Stanford University has continued work begun by Professor Harold Heath, on the clams and edible mollusks of California. A thorough study has recently been made of the Pismo clam, and the results published in fish bulletin number 7. He has also brought together and supplemented surveys of the distribution and use of the edible mollusks of California made by himself and others employed by the Commission. One feature of his work has been the explanation of the periods of scarcity and abundance of the Pismo clam.^c Fish Bulletin No. 4 deals with the surveys.^d

Investigation of the Herring.

Materials have been collected for a study of the age and rate of growth of the herring. The size of the present staff precludes attention to this problem in the immediate future.

Investigation of the Halibut.

Materials for the study of this important fish have been obtained through fishing operations carried on by the boat "Albacore" belonging to the Commission, but due to the pressure of the work on the sardine, this material has been only partially worked up.

General Investigations.

In so far as work along lines not directly of importance in the solution of some problem is concerned, extensive collections have been made with nets designed to capture the eggs and young of our commercial fishes, in hopes that contributions could be made to the life history of the sardine and albacore, and incidentally to other species. Up to the present but little has been done with this material save for the identification of the young of the sardine.

^a Thompson, W. F., 1920. The proposed investigation of the sardine. Cal. Fish and Game, 6, pp. 10-12.

^b 1919. The spawning of the grunion (*Leuresthes tenuis*). (Assisted by Julia Bell Thompson.) Cal. Fish and Game Comm. Fish Bull. 3, 29 pp., 9 figs.

^c Weymouth, F. W., 1921. The abundance of young Pismo clams. Cal. Fish and Game, 7, pp. 103-106, 2 figs.

^d 1921. The edible clams, mussels and scallops of California. Cal. Fish and Game Comm. Fish Bull. 4, 74 pp., 19 pl., 26 figs.

1923. The life history and growth of the Pismo clam (*Tivela stultorum* Mawe). Cal. Fish and Game Fish Bull. 7, pp. 1-120, 18 figs. in text.

There has also been carried on a constant series of market observations and there have been from time to time noted in *California Fish and Game* new records of species of fish taken on this coast, as well as notes regarding their habits.^a

A number of short papers of general interest have appeared in the same periodical, in an attempt to elucidate and explain our work.

Finally, the scientific principles underlying the investigation of marine fishes have been formulated and placed in order of importance in so far as the work at the laboratory is concerned, and in relation to the duties of a government charged with the legal control of the fisheries. This subject is treated in Fish Bulletin No. 2.^b

The Commission will be glad to accommodate at the California State Fisheries Laboratory at East San Pedro, any investigator of fisheries who is interested in problems bearing upon its aims. Accommodations are not unlimited, and request of the laboratory should be made before coming, despite the fact that investigators in such fields are few. Any inquiries concerning bulletins should be addressed to the State Fisheries Laboratory, Terminal, California.—W. F. THOMPSON, in charge State Fisheries Laboratory.

INVESTIGATIONS ON THE ECONOMIC STATUS OF BIRDS.

Considerable game research has been done on the status and economic value of birds and mammals, by Dr. H. C. Bryant, who, since 1914, has been in charge of the educational, publicity and game research work of the Commission. The first study undertaken was with reference to the western meadowlark, which had been accused of being a pest to the grain grower. More than 2000 stomachs of birds taken in all parts of the state were examined and a full report issued.^c As a result of this work, efforts to take the meadowlark from the protected list were abandoned at succeeding sessions of the legislature.

The roadrunner, accused of destroying the eggs and young of quail, was the next subject for investigation. Stomach analysis showed that the bird is in reality an efficient destroyer of insect and rodent pests, and evidence of injuries to game birds was not forthcoming.^d

A study of the English sparrow problem led to the publication of a bulletin dealing with methods of control.^e This bulletin was used in an attempt to interest individuals and especially communities in control campaigns.

Data on the food habits of birds and mammals and on their economic relations, has been gathered continuously, and the farmer now finds a ready source of information on problems dealing with the relation of birds and mammals to agriculture.

^a Higgins, E., 1919. Goat fish taken in California. *Cal. Fish and Game*, 5, p. 156.

1920. Deep sea "monster" captured. *Cal. Fish and Game*, 6, p. 33.

1920. First appearance of the crested band fish. *Cal. Fish and Game*, 6, pp. 34-35.

1921. A strange ragfish at San Pedro. *Cal. Fish and Game*, 7, p. 179.

1921. Cutlass fish taken off Long Beach. *Cal. Fish and Game*, 7, p. 179.

Thompson, W. F., 1918. Rare fish appear off southern California. *Cal. Fish and Game*, 4, pp. 182-183.

1919. Young of the ladyfish discovered. *Ibid.*, 5, p. 158.

1919. The occurrence of the louvar. *Ibid.*, 5, pp. 202-203.

1920. A snipe-fish from Catalina. *Ibid.*, 6, pp. 32-33.

1920. The "runner" fish in lower California. *Ibid.*, 6, p. 33.

1921. A rag-fish at Monterey. *Ibid.*, 7, p. 179.

^b 1919. The scientific investigation of marine fisheries as related to the work of the Fish and Game Commission in southern California. *Cal. Fish and Game Comm. Fish Bull.* 2, 27 pp., 4 figs.

^c Bryant, H. C., 1914. A determination of the economic status of the western meadowlark (*Sturnella neglecta*) in California. *Univ. of Cal. Publ. Zool.* 11, pp. 377-520, 4 pls., 5 figs.

^d 1913. Habits and food of the roadrunner in California. *Univ. of Cal. Publ. Zool.* 17, pp. 21-58, 4 pls., 2 figs.

^e 1916. The European house sparrow and its control in California. *Cal. Fish and Game Comm. Teacher's Bull.* 7, pp. 1-8, 6 figs.

At present the food habits of ducks are being investigated in order to furnish evidence as to the best foods to attract wild fowl to the state. Hundreds of stomachs have been examined and the contents analyzed.

Other investigations have included the present and future status of the California valley quail,^a the status of fur-bearing mammals,^b field identification of California hawks,^c the status and present known distribution of beaver in California, and the present status and distribution of the pronghorned antelope. (See Bienn. Rept. for 1916, p. 112, and Bienn. Rept. for 1918, p. 67.) Statistics of the annual kill of game, and of hunting accidents, are compiled yearly. An important economic problem, the relation of ducks to rice, was undertaken as a joint investigation with the United States Biological Survey, in 1918.

DEER INVESTIGATION.

In 1915, Mr. F. C. Clarke was retained to investigate a disease attacking deer in Trinity County, and the duck disease which makes its appearance at certain alkali lakes in the San Joaquin Valley.^d Also a chemical method of distinguishing venison from other meats was developed, which has been found useful in the prosecution of violators of the deer laws.^e An investigation of the death of water birds at Tulare Lake showed the cause of death to be alkali poisoning.

CONCLUSION.

A review of the scientific work of the California Fish and Game Commission has shown a desire on the part of the members of the Board to attack problems in a scientific manner, investigations being usually placed in the hands of trained scientists from one of the universities.^f That this attitude on scientific research is more than a passing whim, is evidenced by the fact that a State Fisheries Laboratory has been established, with a technical scientist as director and with a staff of three additional research assistants, and that a technically trained director is in charge of game research.

The research work has been of high grade if we apply to the published results the all-important test of time. Most results have thus far shown enduring quality. When measured by the more immediate test, the judgment of contemporary scientists, it proves to be of proper standard. Certainly results have proved meritorious when practical application has been made of them, the test demanded by the average citizen. Furthermore, a wide field has been covered and numerous projects brought to completion.^g

^aBryant, H. C., 1912. Present and future status of the California valley quail. Cal. Fish and Game Comm. Game Bull. 1, pp. 21-33, 2 figs.

^b 1915. California's fur-bearing mammals. Cal. Fish and Game, 1, pp. 96-107, 2 figs.

^c 1921. California hawks: How to identify them. Cal. Fish and Game, 7, pp. 133-147, 2 pls., 8 figs. in text.

^dClarke, Frank C., 1913. Investigation of the large game situation in California, with special reference to deer. Cal. Fish and Game Comm. Game Bull. 1, pp. 6-20.

1913. Preliminary report upon the disease occurring among the ducks of the southern San Joaquin Valley during the fall of 1913. The Condor, 15, pp. 214-226.

^e 1914. Forensic value of the precipitin test in the enforcement of game laws in California. Univ. of Cal. Publ. Path., 2, pp. 131-138.

^fBryant, H. C., 1921. A brief history of the California Fish and Game Commission. Cal. Fish and Game, 7, pp. 73-86, 3 figs.

Westerfeld, Carl, 1919. Accusations and the defense. Cal. Fish and Game, 5, pp. 176-185.

^gBryant, H. C., 1921. Publications of the California Fish and Game Commission, 1870-1920. Cal. Fish and Game, 7, pp. 87-98.

Outstanding results of this attitude on research to be noted are: Valuable data on life history and habits of fish and game useful in planning protection and legislation, and growing confidence on the part of citizens of the state that conservation problems are being properly solved.

If neighboring states would attack problems in the same way, improved results would be possible as a result of the joint effort, and many problems would be more quickly solved and proper conservation attained.

In that the state legislature has acted in accord with data furnished by scientific research and fish and game has benefited with increased knowledge of its life and habits, there is evidence to show that the money expended for scientific research has been well spent and that results have amply justified all outlay. The expense of this feature of the work of the Commission has been very small compared with other expenses. In fact, the outlay in 1920 for research and publicity amounted to less than 6 per cent of the total income which is composed of a direct license tax on those who hunt and fish. Dependable statistics and data obtainable through scientific research should form the basis for all conservation legislation, and every state conservation department will find it worth while to set aside a reasonable sum to provide for the accumulation of such data.

YOUNG SALMON TAKEN AT SEA.

By J. O. SNYDER, Stanford University.

Reports have at times come to the Fish and Game Commission relating to the capture at sea of young king salmon along with sardines, smelt and anchovies which were intended for use as bait. One small salmon taken in Half Moon Bay was reported by Willis H. Rich in 1920. Since then others have been found and something relating to their food, stream history, etc., has been learned.

On June 21, 1921, H. E. Foster of the Fish and Game Commission found some king salmon of the year in the nets of Captain Cressi near Princeton Wharf, Half Moon Bay. Captain Cressi was taking bait fish just off shore in shallow water from about eight o'clock until noon, and 25 specimens from his nets were preserved. Whether more were caught was not reported. The fishermen stated that it was no uncommon thing to find small salmon here, although they were never taken while fishing for bait in Monterey Bay.

June 29, 1922, the Commission secured specimens which were taken by D. Amato and A. Alioto about 200 yards off shore between Lime Point and Bolinas Point. These were caught in the morning while fishing for anchovies with a lampara net. The fishermen said that such salmon are found in the nets every year, and that they are more plentiful during the latter part of August than at any other time. One hundred specimens were preserved.

On June 6, 1923, and again on the 21st, W. L. Seofield found a small king salmon with the sardines from a lampara net in Monterey Bay. These are the only ones that he has reported during the long period in which he has been observing the sardines there.

These young salmon were all small, the two from Monterey Bay measuring 128 and 129 millimeters, respectively. Those from Half Moon Bay measured from 74 to 100 millimeters, averaging 84, while those from Lime Point measured 71 to 110 millimeters, with an average of 82. The sexes were distributed as follows: Monterey Bay, both females; Half Moon Bay, 23 per cent females; Lime Point, 51 per cent females. They were silvery in color, with the parr marks plainly showing.

The stomachs of the Monterey Bay examples contained small fish about 30 millimeters long. The Half Moon Bay fish had fairly gorged themselves with small fish and insects. These small fish, some of which



FIG. 16. Types of scales of young sea-caught salmon. Scale A indicates that the fish remained in the stream during its first year or somewhat longer. Scale B indicates that the fish did not stay long in fresh water but migrated to sea at an early age.

measured about 45 millimeters, had been swallowed head first in all cases, the heads extending into the alimentary tract some distance beyond the stomach. These and also those found in the stomachs of the Monterey Bay salmon were too badly digested for identification. The insects were examined by Eugene C. Scofield, who found that seven families of Hymenoptera were represented, nine of Diptera, thirteen of Hemiptera, five of Coleoptera, and two families of spiders. One regards the quantity and variety of insects found in these stomachs with surprise until he recalls that favorable winds must at times carry large numbers of them out to sea, and that the little salmon, lately from the rivers where such food abounds, would quite naturally turn to them. The stomachs of the Lime Point salmon were not well filled, 28 of them being entirely empty. The food was made up largely of small fish and crustacea, all too fragmentary for identification, a few insects, pieces of annelids, a few small pelagic eggs, some protozoa and diatoms.

Two distinct types of scales have been found on these young salmon, the structure of which seems to admit of the following interpretation. The first type, represented by A in figure 16, is from a fish which remained in the stream during its first year or somewhat longer, the five or six inner rings representing the regular and rapid growth which occurred during the first summer, and the narrower and more closely apposed ones which follow, representing the much slower and less regular growth of winter. The outermost broad rings were presumably formed after the fish reached the ocean, where conditions were more favorable for rapid growth. The little fish bearing this scale is well started in its second year. The second type, illustrated by B in figure 16, is from a fish which did not tarry long in fresh water, but which migrated to sea at an early age. The broad regular rings of which the scale is composed present a record of rapid and even growth. Fishes with such scales are in their first year. The two salmon from Monterey Bay had scales like A in figure 16, which is a drawing of one of them, while all the others were like B. The fish from Monterey Bay, although much older than those from Lime Point, are not much larger than some of them, 128 against 110 millimeters.*

It is probably idle to speculate as to the parent stream of these small fish, especially since it has been shown that Klamath River salmon may migrate to Monterey Bay. It does not seem probable, however, that those having scales like B, and which have probably not been at sea for a very long time, could have migrated far from the mouth of the stream in which they were hatched.

There is revealed here another possible menace to the conservation of king salmon, namely, the capture of young fish by bait fishermen. Whether the number thus taken each year is large or small is not known, but it is quite apparent that those which are caught are destroyed after they have successfully escaped all the vicissitudes of river life, and have become established in the ocean where the possibilities of rapid growth are excellent.

THE EFFECT OF GUNFIRE ON FISHES.

BY WILL F. THOMPSON.

Ever since the first gun was fired from a ship, there has been an uneasy feeling in men's minds that the fishes in the sea were frightened away by the noise of the guns. Now that our fleet has such very large guns, and makes use of them each year in our southern California waters, the belief has recurred with great emphasis, especially in view of the failure of the albacore season here.

The writer, interested in the foundation for such a belief, wrote Admiral Eberle, then in command, for permission to accompany the Pacific fleet during its big battle practice of May 25. The response was cordial and immediate and on the appointed day he found himself on the battleship "Idaho," the guest of the signal officer. The day was thoroughly enjoyed, every feature of the great ship being novel and

*Since the above was written, seven more small king salmon, taken from lampara nets in Half Moon Bay by Mr. Foster on the ninth and twenty-first of May, 1914, have been examined. They measure from 109 to 173 millimeters in length. There were four males and three females. The stomachs of four were empty, while those of the remaining three contained fish fragments. The scales of all were similar to those illustrated by figure A.

impressive, both men and machinery. The captain kindly gave the signal officer permission to install his guest in the forward defense top during practice, a most favorable location to observe the firing from the big guns just below.

These great rifles, fired simultaneously at targets almost on the horizon, rocked the great 30,000-ton steel ship very perceptibly. The motion of the air was violent, and compelled one to hold to a railing, the physical effect of this being heightened by the huge masses of flame and yellow smoke, the change of air pressure and the noise. The discharges of the larger guns was an experience one must remember for a lifetime, especially in view of the novelty of the surroundings. The expectation that preceded each salvo, the sight of the long line of great battleships firing deliberately in turn, brought the onlooker to a tense condition that made him a sensitive subject. And the sensation fully justified the expectation.

With attention devoted to some extent at least upon fishes, there could be seen nowhere in the surrounding waters any sign of frightened fish. During the repeated firing of large and small guns, over a space of many miles, there must have been active pelagic fish present somewhere near. Yet none of them could be observed to leap as frightened fish do, nor could they be seen floating dead from shock, as is the case when dynamite is discharged under water.

Afterwards, when thinking over the sensations, it was a surprise to realize how small a part sound or sharp vibration played in the physical impression received. The officers said that the discharge of the powder took an appreciable time, and was not compressed into an instant in such a way as to produce a sound commensurate with the power exerted. True enough, everyone wore cotton in his ears, but its omission would not have been serious, as the writer found by experiment. The effect on the ship, and presumably on the surrounding water, was as much a sharp, quick shove as a sound.

The landing of the projectile in the water must have been nearly as effective, as a disturbance, yet inquiry failed to show that any fish were killed thereby.

There did not, in fact, appear to be any obvious support for the theory that gunfire affects the abundance of fish. That the contrary was true could have been deduced, without direct observation, from our knowledge of physics. It was not at all to be expected that the sound produced in air, a gas, would reach fish in water with such violence as to injure or greatly excite them, for the sound wave can not be effectively transferred to the heavy fluid. Without attempting to review the scientific literature bearing on the subject, it may suffice to say that actual experiment bears out this conclusion.

There is the well known case of the biologist who found that firing a shotgun over an aquarium did not disturb the fishes therein to any noticeable degree. And there is the more famous instance of the monk who was supposed to attract his carp to the water's edge by the sound of a bell, but in reality drew them by sight of himself. And, then again, every boy knows that when he puts his head under water he can not hear noises above it, but can hear noises made below its surface. vibrations such as gunfire or motor exhausts producing sound in the air are, in short, not very effective in producing sounds in the water.

Now, even were the vibrations produced by gunfire transmitted to the water through the ship it is improbable that their effect would be great upon the fish. In this connection one is reminded of the effect of a photographic flashlight in the darkness upon an animal such as a deer, an effect seen pictured nowadays in the movies occasionally. The sound startles the animal, but not knowing its source or significance, aimless plunging to and fro is the main result, followed by equally aimless flight in any direction. Startled wild animals do not travel far away—they soon pause and forget their alarm if it is not continuous. The more intelligent ones may come to recognize safe areas by repeated experiences, but that is quite a different matter. Even such recognition is not shown by fishes, which may be caught in great numbers in a certain area, and yet the survivors persist in dwelling there.

Considering these things, it is little to be wondered at that fishermen impute to fish such weird, mistaken intelligence that a single occurrence of heavy gunfire suffices to drive them great distances, implying movement day after day in a definite direction out of an area of thousands of square miles. And it is also to be wondered at that the fishermen do not see the inconsistency when the disappearance of certain species is thus explained and the abundance of others is not affected. A logical man would expect the emigration, if of any, of all the vast hosts of animals that are capable of movement, a phenomenon which would lead to the upset of the marine world of life in a remarkable way.

It is necessary, indeed, to place the theory of gunfire as a cause of poor fishing in a class with the supposed effect of whales on the migration of herrings. It is highly improbable, to say the least.

THE LAMPARA NET.

By N. B. SCOFIELD.

Now that the use of the lampara net is firmly established in California and is considered to be a good and legitimate net by nearly all fishermen, it is interesting to go back to the time when these nets were introduced into the sardine fishery at Monterey and to see the bitter opposition which was raised against their use at that time. The introduction of this net has helped probably more than any other contributing factor in the development of California's great sardine industry and it is hard now for fishermen at Monterey to realize that a large number of them bitterly opposed its use ten or twelve years ago. The introduction of any new form of fishing gear which profoundly affects a fishery is usually met with opposition from fishermen who can not successfully compete with their old-style gear, and their opposition is always on the ground that the new gear is unduly destructive and will ruin the fishery.

In 1913 a bill was introduced in our state legislature which prohibited the use or the possession of a lampara net in Monterey Bay, and this bill had a good chance of passing. It is as much the duty of the Fish and Game Commission to prevent ill advised legislation whenever possible as it is its duty to advocate restrictive measures wherever any fishery is in danger of exhaustion. Therefore the Commission, desiring more information in regard to the use of this new net, for the

bill was to come up before the Assembly Fish and Game Committee within a few days, asked the writer to proceed to Monterey and to report on conditions as he found them. After two or three days at Monterey, during which canners and the fishermen in the opposing camps were interviewed and the operation of the net was observed, the following hurried report was sent in and was presented to the committee for whatever it might be worth in its deliberations over the bill which might have held back the development of our fisheries for many years:

THE LAMPARA NET.

The lampara net comes originally from Italy and in some ways is an improvement on the ordinary purse seine. It was introduced into Monterey Bay in 1907. The average net now used there is about one hundred fathoms long and fifteen fathoms deep at the central part. It is suspended in the water in the usual manner by a cork line at the top and a lead line at the bottom. The net at the two ends or brails is very shallow and has a large mesh of about twenty inches. The net gradually deepens toward the center and the mesh becomes smaller until the main or central part of the net is reached, which is about ninety feet deep and has a mesh of three quarters to one inch stretched mesh. The webbing of this center part is hung on the lines in such a manner that when the net is hauled in by the brails it spreads out in a "bunt," accomplishing the same purpose as a bag, with the advantage of being cheaper to construct and easier to handle.

Method of Use.

In the taking of sardines the fishing is done at night and usually when there is no moon. The net-boat and a skiff are towed by a gasoline launch, and when a school of sardines is observed by the phosphorescent "fire" they cause in the water, the net-boat lays out the net in a circle around the school, a man meanwhile remaining in the skiff and disturbing the water with an oar to prevent the fish escaping before the two ends of the net are brought together. Six men then haul the net in over the side of the net-boat. As they get down to the small mesh, toward the middle part of the net, the two ends of the lead line are brought together and pulled entirely in, thus leaving the fish entrapped in the "bunt" of the net. The fish are then taken out with a dip-net and deposited in a boat brought along for the purpose and known as the "lighter." The lampara, on account of the large mesh in the "wings" and the light weight twine of the smaller mesh, pulls very easily through the water. This, together with the simple construction of the net as a whole, makes it a very quick net to operate, requiring less than one-sixth the time that it does to make a cast with a purse net of the same size. A lampara net of the size described costs \$600. They are made in San Francisco. A purse net 150 fathoms long and 12 fathoms deep costs \$2,500.

The lampara, then, is the latest in nets. It catches sardines more economically than either gill or purse net. The steady catch required by a cannery can be much more easily controlled by its use. Fishermen taking sardines with these nets for the two canneries at Monterey strongly defend their use. The fishermen who do not fish for the canneries are very vehement in their denunciation of them. While it is very evident that their denunciation is mainly caused by their being thrown out of employment by its introduction, they claim—with some reason—that the lampara is unduly destructive, causing the loss of great numbers of fish that can not be used for food.

The Case Against the Lampara.

Those opposed to the use of the lampara claim that it can not be used for the taking of sardines without taking large numbers of other fish that are not made use of as food. Anchovies are always associated with and taken with sardines. It is impossible to separate and return them to the water alive.

They say the nets take large numbers of kingfish—at times taking more than can be disposed of, and large quantities are wasted; that last year they caught about forty tons of kingfish in one day—more than the market would stand. They tried to hold them impounded in a net, where they died and had to be dumped.

They say they destroy large numbers of young perch; also that tons of sardines, too large and too small for canning, are wasted or used to make a fertilizer or

chicken food; that they use the net in shoal water, near the beaches, where their lead line reaches the bottom, and destroy young soles, flounders and crabs, and the spawn of fishes; that they fish for squid with these nets, occasionally catching as much as ten tons at a cast. These squid are sold to the Chinese, who dry them and ship most of them to China. They affirm the squid is an important food of salmon, barracuda and seabass, and that the catching of these squid is spoiling the run of salmon in the bay, and has helped spoil the run of barracuda and seabass. That although there is a restricted area where they are not allowed to fish for squid, they do fish for them within this area; or with their light, lure them beyond the area and then catch them.

They claim the nets are used for catching smelt, destroying a great number that are too small to market and that the great destruction of sardines, anchovies, smelt, squid and other small fish—all food of larger fish—has almost destroyed the fishing in Monterey Bay. Seabass, barracuda and mackerel, formerly abundant, now seldom enter the bay.

They object to the lampara because it puts many fishermen out of employment since when the cannery started they caught sardines for them with gill nets, getting for them 75 cents per 100 pounds. They maintain that sardines can be caught in this manner in sufficient numbers to supply the canneries, and that the price of \$15 per ton would be sufficient pay, and the canneries can well afford to pay it; that sardines caught with gill nets are better for canning as they would be a more even size and would not be crushed; that the size of the mesh could be regulated to catch just the size desired. With their use the undesirable sizes would not be taken, neither would the anchovies be taken, but would remain as food for other fish.

They claim that the lampara is a forbidden net in Italy and argue that if it is forbidden there, it must be a destructive net.

They also point out that the net is all the time coming into more general use; the Japanese are getting them. They are being used for the catching of many kinds of fish in the southern part of the state, and that the extensive fishing that will be carried on with these nets will soon put all the fishing into the hands of a few and destroy all the fish.

In Defense of the Lampara.

The fishermen operating the lampara nets, and the cannery people for whom they fish, deny that the nets are destructive. The fishermen deny ever taking smelt, perch, sole or flounder with them. They say they rarely fish near enough to shore for the lead line to touch the bottom, and when it does it covers only a very small circle. The lead line leaves the bottom before the circle is closed, so that the soles, flounders, or any bottom fish would all escape anyway.

They admit using the net for the taking of kingfish on several occasions, but deny that they ever took more than they could dispose of.

They admit catching squid, but deny they took them in the quantities reported. That aside from taking squid, and on a few occasions kingfish, they take only sardines and the few anchovies associated with them and that they do not take sardines too large and too small for canning. The larger sardines, those middle sized, and the smaller ones, which are younger, school by themselves, and being easily distinguished in the water, only usable ones are caught. There are very few small sardines anyway. They claim that they can distinguish schools of anchovies from sardines; or can tell when a school is of anchovies and sardines mixed; that they can estimate quite accurately before the net is cast how many and in what proportion they will be caught. They offer to demonstrate this at any time and ask for a fair investigation before the net is condemned.

They admit it is impossible to catch sardines with the lampara without catching some anchovies, although they often do make hauls of clean sardines. The two species evidently feed on the same minute organisms, and are thus thrown together. During the fore part of the sardine season, which usually extends from August 1st to December 15th, there are very few anchovies; the anchovies are most abundant toward the end of the sardine season. They point out that anchovies are extremely abundant everywhere along our coast, and are little used as food; that the quantity caught in the taking of sardines can never appreciably diminish their numbers. The fishermen contend that the sardines, until the canneries were established on the bay, were little used as food and that they have established a new industry, employing many people. The sardine although found all along our west coast in immense numbers, spends two-thirds of its time at sea, appearing on our shores for only about four months of the year.

Owing to its anadromous nature, and with practically the whole sea to draw on for their supply, the number of sardines will not be diminished, even with more extensive fishing than that now carried on.

The sardine canners admit that sardines caught by gill nets would be better for canning, but claim it would be extremely difficult to operate if they had to depend on gill nets and gill-net fishermen; that the additional price they would have to pay for fish would make canning unprofitable; that the supply of sardines could not be regulated with such a large body of men and would often result in a loss of fish; that when fish were not plentiful they would not fish. The canners first employed men to fish with gill nets and it did not work. They then tried hiring fishermen by the month, but that worked no better. Then other kinds of nets were introduced and finally, in 1907, the lampara was first used.

They state that this complaint of the scarcity of fish in Monterey Bay is not new; nor did it start with the use of the lampara net. Mackerel never have been plentiful—at least in the last twenty years. Monterey Bay is about the northern limit in the range of seabass and barracuda, and their scarcity could be caused by many things besides a lack of small fish for food. Excessive fishing below Monterey Bay for the fish themselves could cause it; and they are fished for excessively about the Santa Barbara Islands. Or if these fish were to find an abundance of food below Monterey, they would need to come no further north. That they certainly would find plenty of anchovies and sardines for food in Monterey Bay is certain if they cared to come.

In defense of the charge that they are using fish to make fertilizer at Booth's cannery, they say: They are utilizing a waste product; that the material that goes into the fertilizer is the waste from the sardines (heads, entrails, etc.) and the anchovies that are unavoidably taken with the sardines. Fish oil is expressed from this waste, and the remainder after cooking, chopping and drying was first sold as fertilizer, but recently it was found that it could be disposed of at a higher price as a chicken feed.

In my opinion the fault is not so much with the net itself as with the manner in which it is used. If its use should be restricted to the taking of sardines, the waste would be confined to anchovies, which need not amount to more than five per cent of the total catch. As far as Monterey Bay is concerned, its use could be restricted by law. If it is found that the take of anchovies can not be held down to five per cent, the latter end of the sardine season, at which time the anchovies are most numerous, could be closed.

The squid is an important food for fish in the bay. They are little used as food in this country, and their capture could be prohibited.

The only uncontradicted evidence against the net itself is the destruction of anchovies; and also that of depriving a number of men from making a living catching sardines with gill nets for the canneries. The complaints emanate from these fishermen not employed in the sardine fisheries. Other fishing is not so good and they have difficulty in making a living. They would like an equal chance with the others in taking sardines.

The sardine season at Monterey lasts usually from the first of August to the middle of December. Fishing is almost all within the bay and on the Monterey side. The Booth cannery was established in 1904, when 200,000 pounds of sardines were taken. The take increased until this cannery in 1910 took approximately 3,000,000 pounds. The take so far this season is 1,343,600 pounds, and that of the other cannery (Pacific Fish Company) probably about one-third of this amount. The number of anchovies taken this year, they say, was above the average, for the anchovies were more plentiful. The number taken this year at the Booth cannery was 150,400 pounds, which is about ten per cent of their total catch. Twenty tons of these were salted for bait; the rest went to the fertilizer plant. The fishermen were paid \$10 per ton for the sardines, and for the anchovies \$5 per ton. This price of \$5 per ton for anchovies no doubt made the capture of anchovies an object, and the ten per cent was much larger than it needed to be.

The fishing gear is virtually owned by the canneries. The cost of the gear operating for the Booth cannery they estimate at \$10,000. About one-half of this is for boats.

I could find nothing about the net being prohibited in Italy.

Lampara nets have been bought by fishermen on Monterey Bay, one or more by the Japanese, who expected to use them for other fish than sardines. Several nets of this type, but larger, are now used in the southern part of the state. There are no data as to the amount of fish they capture or per cent of waste. To regulate a matter of the sort requires more accurate information than is at hand. To know

just what effect these nets are likely to have, a competent observer should accompany the boats in each locality throughout a fishing season.

The Fish and Game Commission decided that the net should not be abolished unless future investigation showed that the net could not be used without being unduly destructive and it therefore opposed the bill, which was finally defeated. At that same session of the legislature another bill was introduced which prohibited the use or possession of paranzella or trawl nets in the state. The bill was aimed at the trawl fishery outside of San Francisco Bay and was supported by fishermen who had opposed this improved method of fishing, since its introduction, for economic reasons, but their claim was that the nets would destroy all the fish and crabs in that part of the ocean. It was the same fight, in miniature, which was carried on in England and Scotland against the more efficient steam trawlers. This bill was also opposed by the Fish and Game Commission and was defeated.

The two fights against the improved fishing methods, which have since then developed two of our most important fisheries, show how necessary it is that we should guard against condemning any new method of fishing just because the more efficient apparatus interferes with those using the older methods. The cotton gin and other early labor-saving machinery met with similar opposition. The present opposition to the use of purse seines in southern California is much the same thing—an economic contest rather than one which has to do with the conservation of the fisheries.

This old report—for, compared with the rapid development of our fisheries, it is an old report—brings to our mind several important changes which have taken place. In those days the sardine season ended about the middle of December at Monterey. Now December and January are the big months and canning continues into March. To take anchovies in any quantity with the sardines is the exception now rather than the rule. This is probably not due to a scarcity of anchovies but is due to an increased abundance of sardines. In those days it was more difficult to make catches of sardines and the two canneries were frequently closed during the season on account of the lack of fish. Now there is seldom a lack of sardines and this can not be explained on the theory that the fishermen have become more skillful through accumulated experience. But we are more apt to be impressed by the growth of the fisheries in this brief period. Then there were but two sardine canneries at Monterey and the sardine catch was about three million pounds a year. Now there are seven sardine canneries and sardine salteries at that place and the catch of sardines at Monterey in 1923 was eighty-five million pounds. The sardine industry of southern California, using almost as large a catch, has developed during this same short period of time.

CALIFORNIA FISH AND GAME.

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

April 17, 1924.

"Piecing out the other fellow's bag limit is like licking his plate—it can be done but isn't."

ONE'S FAIR SHARE.

Every sane conservationist eventually comes to see that man has handled natural resources very thoughtlessly. It is quite evident that man has "dominion over the fish of the sea and over the fowl of the air, and over every living thing that moves upon the earth." Time has demonstrated that so long as he utilizes plant and animal life for his immediate needs, conditions remain favorable, but when through greed he begins to take more than his just share, useful forms of life tend to disappear. In the pioneer days, when a man took for himself and the needs of his own family, game maintained itself, but when spurred by greed or by financial gain he took more, then followed depletion. As looking toward this viewpoint there needs to be much less emphasis placed upon the limit bag and more emphasis upon leaving some game for the other fellow. Read again the quotation at the head of the editorials.

CYCLES OF ABUNDANCE AND SCARCITY.

As we work out the life histories of various birds and mammals, and particularly as we take censuses, we discover that practically all of the species are subject to considerable fluctuations in abundance. The lemmings of Europe and the varying hare of Canada are stock examples. Yet within our own state almost everyone has seen periods of abundance and of scarcity in rabbits and

mice. Many have noted considerable fluctuations in the numbers of quail. Just at present there is a notable scarcity of tree squirrels, owing to the ravages of disease.

If these fluctuations be a well established fact, doubtless most of the game birds and mammals have similar cycles of abundance and scarcity. Furthermore, under such circumstances, can we expect to properly administer our game resources if we fail to have flexible laws? Should quail be reduced to the minimum some year, we might have to wait for two years until a meeting of the legislature before any change could be made in the law, and this might come too late for the good of the species. Should deer be reduced in some portion of the state, as they are in Modoc County, it again might take two years before a change could be made, and, even with a meeting of the legislature, a change might be impossible due to the usual difficulty of modifying the law.

This editorial was inspired by a splendid article entitled, "Cycles of Abundance and Scarcity in Certain Mammals and Birds," by A. D. Henderson, which appeared in the November number of the *Journal of Mammalogy*. Here is Henderson's conclusion:

"In view of these facts it will be seen that, while legislation can help, it can not alter these natural conditions, and care should be taken that it should be based on a knowledge of the life history of the species it is desired to protect. The ideal system would seem to be to give complete protection in the natural periods of scarcity and a liberal open season and bag limits in the period of abundance. In fact, it would seem that when the numbers of a species approach the maximum, a considerable reduction in numbers would be advantageous to the species rather than otherwise. This of course applies only to species of birds and mammals in territories where these cycles of abundance and scarcity occur."

WHAT WILL RECLAMATION LEAVE US?

First it was the marshes that were drained to furnish land and now come the lakes. When reclamation of this sort has proceeded so far that two of the states noted for their many lakes, Wisconsin and Minnesota, have become so disturbed over the future scenic beauties of their landscapes that there is a determined fight to prevent additional destruction of beautiful lakes, it is high time for some of the Western States, with their comparatively few bodies of water, to take a like stand.

A few years ago conservationists fought in vain to prevent the destruction of the finest wild fowl breeding grounds of the state, those surrounding Lower Klamath Lake. Visitors to this drained lake-bed for years to come will readily concede that a mistake was made.

Now comes a proposal to drain one of the most beautiful lakes of the north coast region—Lake Earl, six miles north of Crescent City, in Del Norte County. Sufficient signers were secured to form a reclamation district and a plan is on foot to drain the whole lake by pumping into a smaller shallow lake of sandy bottom which empties into the ocean, the bottom of the lake having been taken up under the swamp and overflow act about 1910. In addition to its scenic beauty, this lake has furnished some of the best of fishing in the area, having been stocked regularly by the Fish and Game Commission. Furthermore, this lake has formed a refuge for many waterfowl during the winter season.

What can be done? In Minnesota an attempt to lower the level of Swan Lake and eventually to drain it was successfully blocked by conservationists. And why should it not be possible to do a similar thing in California? When one stops to think, such a lake now affords hunting, fishing and boating for many, but, as a result of draining it, only a few farmers will benefit. From the legal point of view, we are disposed to think that a few individuals of this region have no right to destroy fish and game resources owned and maintained by the commonwealth for the benefit of all.

Be assured that the near future will see many similar proposals to destroy the most beautiful and accessible lakes of the state. Unfortunately, it is to be expected that apathy will rule and that these valuable heritages will be taken from us and regrets left to a future generation.

IN MEMORIAM—EARLE DOWNING.

It is with deep regret that we record the death of Earle Downing, which took place on February 24, 1924, at his home at 671 Lerida avenue, Oakland, thus terminating nearly sixteen years of faithful service as an Assistant Fish and Game Commissioner. He was still what we would call a young man, for he was but 43 years of age.

Always of robust health and abundant energy and without ever experiencing a serious illness, he began suddenly to fail about three years ago due to thyroid trouble. He still retained his enthusiasm and his jovial, cheerful disposition, and he

contended that he felt as well as he ever did. For the very reason that he felt all right he was inclined to overtax his physical strength. A thyroid operation bade fair for a time to restore his health, but other complications had meanwhile developed. Not until about three weeks before his death, when his condition became suddenly worse, did he consent to give up his official work.

Born in Missouri in 1880, he was brought to California when but 2 years of age by his parents, who settled at Pleasanton. Here he spent his early youth—attending school, fishing and hunting, and later working in a store. He went to Palo Alto and assisted his brother Henry, a building contractor, and at the same time attended school preparatory to entering Stanford University.

At the outbreak of the Spanish-American war, while he was yet under 18 years of age, he gave up his school and carpen-



EARLE DOWNING.

tering to enlist as a volunteer. One of his regrets was that he did not get to see actual service in either Cuba or the Philippines.

After the war he returned to Pleasanton and engaged in mercantile business. He became an ardent sportsman and was a skillful angler and hunter, and was a prime mover in several fish and game conservation clubs.

In 1908 he accepted a position with the Fish and Game Commission as patrolman with his headquarters at Pleasanton. He frequently assisted in the commercial fisheries patrol and early became interested in this branch of the Commission's work. In the latter part of 1917 he was transferred to the Department of Commercial Fisheries, acting first as field agent. Later he took up the additional duties of superintending the commercial fisheries patrol of northern California and had charge of the maintenance of the Commission's boats. About six months ago he took over the supervision of the Commission's water pollution work, a very considerable task in itself, and up

to within a few days of his death he was making plans for the future enlargement of this work.

He was married in 1905 to Miss Marian Johnston, who, with their 16-year-old daughter, Elizabeth, survives him. He was a member of Alameda Lodge 1015, B. P. O. Elks; Alisal Lodge No. 354, F. and A. M., and Pleasanton Camp No. 162, W. O. W.

Wherever he went he made friends and he did more than any one man to bring about a friendlier relationship between the Commission and the commercial fisheries interests. His gift for making friends made him invaluable to the work and we now realize how much we depended upon him. If there was some difficult piece of work to put through against opposition and where diplomacy was required, it was "Have Downing do it." He was frequently called upon for assistance by other departments of the Commission and when, during the last war, the State Food Administrator was in need of a man in his office who could advise him in fisheries matters, he asked for and got Downing. Always willing and with his heart in the work, his loss will be profoundly felt by the Fish and Game Commission, while his host of close friends will feel his absence most keenly.—N. B. S.

IN MEMORIAM—S. L. N. ELLIS.

S. L. N. Ellis, Assistant Fish and Game Commissioner, died at his home in Fresno, March 10, 1924, after a brief illness. Ellis was born in San Luis Obispo County sixty-four years ago. In early life he moved to Tulare County, where he taught school for several years. At the time of his death he held a teacher's life diploma. He was appointed deputy assessor and served for four years, and was later elected county supervisor, which office he held for sixteen years. For eight years he was in the employ of the United States Forest Service as ranger and supervisor of the Stanislaus National Forest.

A true sportsman in every sense of the word, and a great lover of the mountains, Ellis spent much of his time in the Sierras. He was familiar with practically every trail from Tuolumne to Kern; in fact, many of the trails were built under his direction and probably, partially at least, at his own expense. He supervised or assisted in extending the range of golden trout so that today this magnificent species is found practically throughout the high mountains south of the San Joaquin. In 1892 he outfitted an expedition and transplanted golden trout from Whitney Creek to the north fork of Kaweah.

A man of wonderful character and personality, Ellis numbered his friends by the hundreds. He was intimately acquainted with such men as John Muir, Joseph Le Conte, Bolton Coyte Brown and Stewart Edward White, and many others. In two of Stuart Edward White's books, "The Pass" and "The Rules of the Game," he is a prominent character.

As an employee of the Commission, Ellis' services were always satisfactory. No matter what detail he was on his work was carried through with credit to himself. Although a thorough believer in the strict enforcement of the conservation laws, he made friends rather than enemies whenever he made an arrest.

It is said that his funeral was the largest that has been held in Fresno for the last ten years. The burial services were under the auspices of La Palms Lodge, No. 366, F. and A. M. Besides his wife, he leaves four sons and a daughter to mourn his passing.

J. S. HUNTER.

RECORD FINES GIVEN LOS ANGELES COUNTY VIOLATORS.

Last fall a violator of the deer laws, W. D. Newell, was apprehended in the Malibu Mountains of Los Angeles County by county game wardens and taken before Judge Powell at Sherman. He pleaded guilty to four out of seven counts against him and was given a total fine of \$1,900, which he paid, and a sentence of six months in jail, which he is now serving.

Judge Powell, when three Japanese were arraigned before him for shooting a fawn, gave the maximum fine of \$500 to the man who actually fired the shot, and \$200 and \$50, respectively, to the other two who helped him pack the deer out.

Similar heavy fines have been handed out by Judge Miller of Newhall. In one case a deer was shot some two weeks after the close of the season. The offender was given the maximum of \$500. In another case, a fine of \$300 was imposed.

WHAT ARE WE GOING TO DO ABOUT IT?

"The old days of wanton destruction have gone forever. Never again will wild ducks and valley quail be offered for sale in public markets. Wise laws have forbidden that, yet in spite of these laws and of the honest, earnest protection offered by clean hunters and efficient game wardens, our supply of valley quail has diminished to the danger point."

Such is the statement made by the San Diego Fish and Game Protective Association and used as a reason for the

introduction of ring-necked pheasants and Hungarian partridges. We prophesy that some day San Diegans will curse the citizens of the twentieth century for apathetically allowing the finest of western game birds to disappear without taking every available step for securing its preservation.

UNWISE DRAINAGE AFFECTS WILD LIFE RESOURCES.

It is estimated that half a million acres of lake, swamp and marsh land has been drained in this country during the last few years. When the results justified the project there was no complaint, but now that some of the best breeding grounds for waterfowl are being destroyed, with losses more than offsetting the returns in arable land, reaction has set in. Guardians of game resources know that the future supply of game is dependent upon abundant and safe breeding grounds. Reclaim brush land, and the resident quail are either driven to cultivated fields or disappear, for their natural food supply has been destroyed: reclaim marsh lands, and ducks are driven elsewhere or disappear.

Duck hunters in California take a toll of not less than 1,000,000 ducks during each open season. What is the source of supply of the hordes of waterfowl that annually winter in California and that make such a harvest possible? As everyone knows, most of the ducks killed are reared in the marsh areas of the north. With continual drainage of marsh areas in California, the supply is more and more dependent upon winter visitants from the north. It would be common sense to rear as many birds within our own state as possible so as to assure a continuous supply.

However, instead of creating breeding grounds, we are continually destroying them. The state's largest and finest of breeding grounds was destroyed a few years ago on the pretense of the acquisition of valuable agricultural lands. Lower Klamath Lake, in the northeastern corner of the state, was drained with the consequent destruction of age-long breeding grounds of hundreds of thousands of ducks and geese. The soil having proved to be strongly alkali, only an exceedingly small portion of the land is being cultivated. By returning this area to its natural condition, extensive natural breeding grounds for waterfowl could be secured for California. The reflooding of the lake is possible and to make it an assured thing an awakened public sentiment to the needs of waterfowl is necessary. The California Fish and Game Commission is heading a campaign for the reestablishment of the

Lower Klamath Lake breeding grounds for waterfowl.

GAME CONDITIONS MIS-REPRESENTED.

Posters recently issued by the Permanent Wild Life Protection Fund purports to warn everyone that the 5,000,000 men who hunt annually in the United States are exterminating game and sport. The slogan is "Beware of a gameless continent." Sentiment expressed is in direct contrast to that of the American Game Protective Association, which continually maintains that protection of game is almost entirely dependent upon sportsmen because they are the ones directly interested.

It is to be noted also that these posters grossly misrepresent the quail and grouse conditions in the western states. A map shows the states shaded in which quail hunting is said to be extinct. All of the Pacific coast states, with the exception of Washington and Idaho, are so shaded. Apparently the map pertains to bob-white quail only, but since bob-white were never native in these Pacific coast states it is hardly fair to give the idea that quail shooting has become extinct in these states. Another map pertaining to grouse is misleading in the same way, since the shaded states are not all states in which grouse were once abundant but in which they are now given total protection.

A truly false statement is to be found in this relative to deer: "In California a live wild deer is almost a curiosity."

The Permanent Wild Life Protection Fund demands a 50 per cent reduction in killing all along the line.

GROUSE DISEASE IN NEW YORK STATE.

According to a report by Dr. Arthur A. Allen of Cornell University (Bull. Amer. Game Prot. Assoc., Jan., 1924), ruffed grouse in New York State are infested with stomach worms, *Disphragus*. Fourteen out of sixty-five stomachs examined during 1923 contained parasites. Five out of thirty-five birds collected in the vicinity of Ithaca were infested. Not only is this disease prevalent in the wild, but it is the most dangerous disease with which the breeders of grouse have to contend.

CAUGHT SELLING DUCKS.

On information from Woodland that certain men had taken ducks to San Francisco to sell them, Deputy M. S. Clark succeeded in rounding up R. E. Luck and Lawrence Diendomme with 154 ducks in their possession. The birds were concealed in a machine and the men were

making the rounds of restaurants and dealers attempting to dispose of them. When taken before Judge Lazarus, the men plead guilty, and Dieudonne, who had killed the ducks, was fined \$100, and Luck, who transported them, was fined \$25.

GROUSE CONSTITUTE PROBLEM IN NEW HAMPSHIRE.

According to Mott L. Bartlett, Fish and Game Commissioner of New Hampshire (Bull. Amer. Game Prot. Assoc., Jan., 1924), New Hampshire is having difficulty with a law which provides for the remuneration of farmers damaged by the bud-cutting activities of ruffed grouse.

turned down with no settlement. It took about \$25,000 of the fish and game funds to pay the claims.

The birds work largely in the tops and center of the trees. Orchardists claim that where the end of the fruit spur is broken off it takes from two to five years for the trees to recover. This is not always true, however. As is so often the case, claimants for damage may be classified as those who have real damage and are fair minded; second, those who have real damage but who exaggerate its value; and lastly, those who seek an opportunity to collect something from the state.

It appears an injustice to make the sportsmen bear the burden of reimbursing

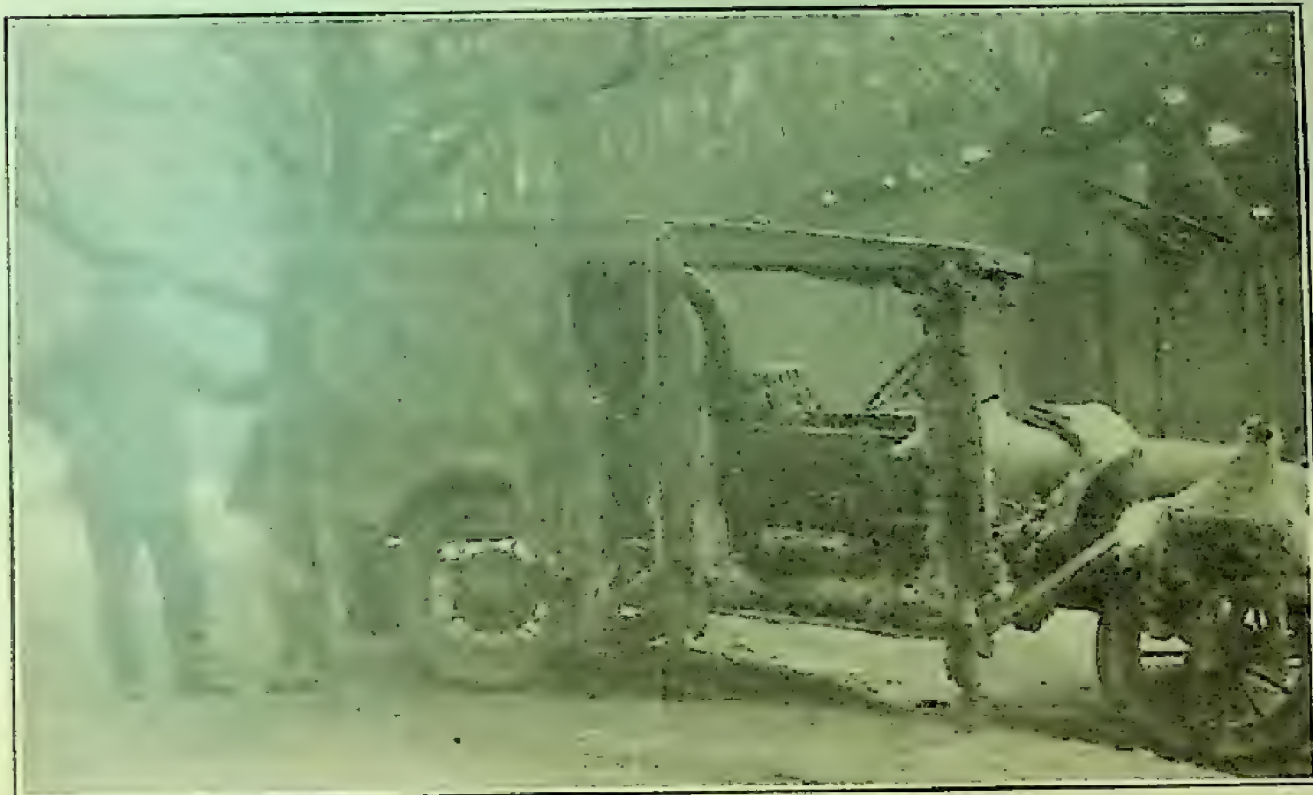


FIG. 17. State Lion Hunter Bruce returns from a three weeks' hunting trip with six lions, three of which were taken in half a day. Photograph taken January 28, 1924, by H. C. Bryant.

Apple growing is rather a new industry in New Hampshire. A new food supply plus three particularly good breeding seasons and three severe winters when food supply was at a premium, has brought about a combination of circumstances which presents a difficult problem. At the 1915 session of the legislature, a law was passed providing for the payment of damage done to "annual crops or fruit trees by game birds or game quadrupeds protected by law." A few complaints of grouse budding were made in 1921, but there were comparatively few claims. In 1922, claims became numerous. During 1923, 257 claims aggregating slightly under \$19,000 were paid, with about forty other claims in dispute and 100 others

those injured. A fairer method would require reimbursement from the general funds of the state so that the burden would be borne proportionately by all citizens.

STATE LION HUNTER SECURES SIX LIONS IN JANUARY.

A three weeks trip during January to the vicinity of Sequoia National Park netted six lions for Mr. Jay Bruce, state lion hunter. Reports by Deputy Bullard, of Dunlap, Fresno County, to the effect that stock and many deer had been killed by lions, drew the lion hunter to this locality. Two weeks were spent northeast of Dunlap with the result that two males and one female were treed and killed.

Mr. Bruce then moved to Sequoia National Park, at the request of John R. White, superintendent of the park, who reported plenty of sign. Tracks were soon picked up on the main road and on January 25 a large male was secured. This lion showed definite signs of a fight, having lost two toes on the left forepaw and being scratched and injured about the head and shoulders. The trail of a smaller lion was picked up nearby and this led to the dead carcass of another smaller male lion about a half mile distant. This smaller animal had apparently died from wounds on the head and shoulder—plainly the result of a fight. A lioness which was bedded down near the carcass was soon treed by the dogs only 200 yards away, making six lions for the three weeks trip.

LION HUNTER GETS LIONESS AND FOUR CUBS.

State Lion Hunter Jay C. Bruce, following his "three lions in three hours" between Giant Forest and Colony Mill at the end of January, hunted for two days between Colony Mill and Burdick's Ranch, February 7-9, accompanied by Ranger Fry of Sequoia National Park. Only one old track was found and no luck, so Bruce, accompanied by Chief Ranger Hopping of the park, shifted to the South Fork region with base at Clough's Cave. Here, on the second day's hunt, five lions were secured within three hundred yards of the Ranger Station at the Cave. A six-foot, ninety-pound female had established herself and family of four cubs at the base of the rock immediately below the hanging bridge forming the approach to the Cave entrance, and was killed after being treed by the hounds a few yards away. Quick action on the part of Mr. Bruce in calling off the dogs saved the life of a single

kitten, the rest, unfortunately, falling victims to the pack. The lion cub, less than two weeks old, was cared for at the Cave by Mr. Bruce and Ranger Dorr, and was brought out alive.

Mr. Bruce states that this success brings the total of lions secured by him to 192. The hunt was continued in other sections of the park.

DUCKS TO BE BANDED IN ARCTIC.

"The Survey," Washington, D. C., states that bird-banding experiments in the Arctic are to be conducted in connection with a United States Geological Survey expedition, which sailed on June 6 from Seattle, Wash., for Nome, Alaska, planning to spend the summer between that place and Point Barrow. Included in the party is Captain Joseph P. Bernard of Montreal, Quebec, who has spent many seasons on the Arctic coast of America as captain of a whaling vessel. Captain Bernard has been supplied by the Survey with aluminum bands and it is hoped that he will be able to band a number of ducks and geese whose northernmost breeding grounds are found in the area that will be visited by the party. During his northern trips, Captain Bernard has specialized in the study of the nesting of waterfowl and shorebirds, a training which speaks well for the success of the volunteer work which he has undertaken.—*The Wilson Bulletin*, September, 1923, page 178.

CENSUS OF CALIFORNIA'S BIG GAME.

According to the annual report of the Committee for the Conservation of Wild Animal Life of the California Academy of Sciences, a census of the past year of the big game of the state shows about 1000 antelope and about 400 elk. A summary of the report follows:

MOUNTAIN SHEEP.

Reported by	Date	Locality	No.
Edwin H. Ober.....	Nov., 1922	Death Valley ranges.....	155
	Summer and fall to		
	Oct. 20, 1923	Inyo Sierras.....	26
Edmund C. Jaeger.....	Nov. 6, 1923	Five locations in Riverside and San Bernardino counties.....	19
Arthur T. Shay.....	Oct. 25, 1923	Three locations, Mt. San Antonio (Baldy).....	12
Total.....			212

ANTELOPE.

John O. Miller.....	Feb. 18, 1923	Mt. Dome, Siskiyou County.....	118
W. J. Lee.....	Sept. 29, 1923	About twenty locations in Lassen county.....	801
Sam L. N. Ellis.....	Nov. 19, 1923	Fresno County.....	14
Edwin L. Hedderly.....	Nov. 20, 1923	Los Angeles Refuge, Kern County.....	11
Total.....			1,007

CALIFORNIA VALLEY ELK.

Reported by	Date	Locality	No.
C. Swanston & Son.....	Jan., 1922	Swanston ranches in Colusa and Yolo counties.....	13
Washington B. Lewis.....	Oct. 1, 1923	Yosemite National Park.....	8
Colonel John R. White.....	Oct. 15, 1923	Sequoia National Park, on Main Kaweah River, Tulare County.....	112
Del Monte Properties Company..	Dec. 6, 1923	Forest, Monterey County.....	130
Miller & Lux Ranch.....	Dec., 1923	Buttonwillow, Kern County.....	*105
Total			408

†Approximately.

*Report of parent herd (approximately 400 animals) on Miller & Lux Ranch. Based on airplane census of September 24, 1921, as follows: Two herds of 150 each; scattering, 25; total 325; increase for 1922-23 estimated as 25 per cent (probably 50 per cent), 80; total for December, 1923, 405.

In 1914, 1915, and 1921, valley elk were distributed to a number of locations other than the above, but no late reports have been received as to their increase or present condition. Most of the animals have disappeared except as above noted. Dated, San Francisco, January 1, 1924. M. Hall McAllister, Chairman.

MINNESOTA FIRST STATE TO ESTABLISH SEASON DUCK LIMIT.

In spite of the difficulty attendant upon the enforcement of season limits, because of the lack of the "possession clause," Minnesota has placed a yearly limit of 135 birds on all of its wildfowl shooters. This is the first state in the Union to attempt such a limit. However, according to E. W. Nelson, Chief of the Bureau of Biological Survey, several of the Canadian provinces have seasonal limits on ducks and other waterfowl. British Columbia having led the way a number of years ago. The present Canadian regulations under the Migratory Bird Treaty contains seasonal limits on waterfowl for several of the provinces.

Thus does the state, whose records show that more than a million ducks are killed each year, attempt to regulate the toll in order to assure a continuous supply.

WIDE INTEREST IN GOULD LEAGUE OF BIRD LOVERS, AUSTRALIA.

The Gould League of Bird Lovers, established in the State of Victoria in 1909, an organization which corresponds to our Audubon Society in America, has enjoyed a remarkable growth. Leagues have been organized in most of the other states in Australia and the membership in Victoria alone is now 72,000.

As with our Audubon societies, the purpose is to foster the love for and appreciation of native birds to the end of preserving them. It is primarily an organization for children, though not limited to children. Many adults have shown their interest by joining and by the making of donations for the advancement of the work.

Articles are published in the school papers and numerous competitive activities are carried on among the children designed to keep up their interest and to

stimulate study and observation. An annual "Bird Day" is observed with field trips conducted by teachers and bird lovers and with evening demonstrations consisting of the varied competitive activities of the school children, lectures and moving pictures.

Aside from occasional donations, the only source of revenue is a small membership fee from which the expense of conducting the prize competitions are met.

KLAMATH SALMON MARKED IN 1922.

In the fall of 1922 25,000 king salmon were marked by removing the adipose and left ventral fins, and then liberated in Klamath River.

Some of these may be expected to return to the river or be taken at sea as grilse of the third year in 1924, the fourth year fish appearing in 1925. Others may be caught later.

The eggs from which these fish were hatched were taken in the Klamath near Hornbrook. Of the marked fish 18,500 were reared in ponds at the hatchery on Fall Creek, a tributary of the Klamath, and liberated in the stream; and 6,500 were reared in ponds at the Sisson Hatchery, transferred to the Klamath and liberated just below the racks near Hornbrook.

The marking was done by E. A. McGregor, E. C. Seofield, and J. O. Snyder. The fishes were liberated under the direction of Captain G. H. Lambson and Mr. E. V. Cassell. The usual precautions were taken to insure complete removal of fins, careful handling of fish, and the preservation of necessary sample specimens.—J. O. Snyder.

CROW SHOTS.

The American Game Protective Association has been advocating crow shoots by sportsmen, maintaining that the bird is

an enemy of game. Furthermore, an effort is being made to line up all of the state game commissions behind a nationwide campaign against "vermin." Note that in addition to the crow, destructive hawks and owls, weasels and cats are considered "vermin." In the writer's experience many hawks, owls and weasels are scarce enough already to make them objects of great interest without the necessity of organizing an army of destruction. Furthermore, the writer, after specialized study of the food habits of birds and the microscopic examination of hundreds of bird-stomachs, has never been convinced that predatory species have as direct effect on the numbers of the species preyed upon as many would maintain, because of the variety of food taken. Crows do not eat the eggs of game birds exclusively nor do owls prey exclusively upon game birds. As a result, their destruction does not have a direct effect upon numbers of game birds but does seriously upset the balance and make artificial control still more difficult.

The Boise (Idaho) Fish and Game League, following the lead of the Montana Fish and Game Association, has been advertising the results of a recent crow shoot which netted 228 crows, 254 magpies, 28 hawks, 4 owls and 2 bobcats. What we would like to know is how many of these birds really merited death because of damage done. How many of the hawks and owls killed were those of species known to be harmful? Undoubtedly, crows should be reduced in number in many places because of depredations on crops but there is doubt as regards the justification based upon the destruction of game birds. Where can we stop if we start killing everything that preys upon something else?

"If every sportsmen's association throughout the United States would do its full duty towards these predatory birds, there is no doubt that the increase of game birds resulting would be noticeable in a short time." We wonder! The writer knows of an area where for years systematic trapping of predatory mammals has been carried on, but with noticeable decrease in valley quail. There is a fallacy in this theory about vermin. Is it not to be found in the fact that there are many factors concerned in the increase and decrease of a game species and that so-called vermin is but one of these factors and, perhaps in reality, but a lesser one? When we know more about the many factors concerned and know something about their interrelations we will be able to act with better judgment and greater effectiveness.

CROWS NOT SO BLACK AS THEY ARE PAINTED.

Crows have recently been roundly condemned in numerous sportsmen's periodicals and newspapers because of their destructiveness to other bird life, especially game birds. The articles, which were based on information gathered on the coastal islands of Virginia by an expedition financed by a well-known ammunition company, have made a profound impression in many quarters. Under emphasis on peculiar local conditions, however, together with lack of distinction between the common crow and the fish crow and a faulty interpretation of the evidence at hand, there has been conveyed a grossly exaggerated and wholly erroneous idea of the predatory habits of the crow, according to specialists of the Biological Survey, United States Department of Agriculture.

That the situation is by no means so serious as pictured is apparent from statements in the articles that the Virginia islands mentioned abound in game and are the favorite nesting places of large numbers of marsh birds. The whole district also is, and has been for many generations, one of the favorite hunting places of the East.

There is no question that on these Virginia islands the fish crow and the smaller numbers of the common crow present are to be seen at their worst, as regards their relation to other birds. These objectionable traits have been given due consideration in the efforts of the Biological Survey to appraise correctly the economic worth of the crow. Such activities, however, must be placed in their true perspective, and evidence secured under peculiar local conditions can not serve as a basis for a universal estimation of the species.

Government experts state that the bird to blame for most of the vandalism on the Virginia islands is the fish crow, a species quite different in habits from the common crow. While mention has been made of this fact in the articles referred to, the difference is frequently lost sight of and the whole race of crows is condemned by the evidence obtained largely against the maritime species.

The number of eggs of other birds reported to have been found under crow nests also has been emphasized. Under a right interpretation this evidence will have a less serious meaning, so far as other bird life is concerned. Scientists state that breeding birds readily replenish losses due to egg destruction, and under the conditions described the production

of two or more sets of eggs before a brood is brought forth is doubtless the regular occurrence.

The Biological Survey takes the attitude that on game farms and on reservations where both time and money are spent to maintain bird life in more than normal numbers, control of certain injurious species, including the crow, is warranted and even necessary. Government experts have done considerable experimental work and advise control measures in localities where the birds are injurious to crops. On the other hand, a careful study of the economic status of the crow demonstrates that over much of its range the bird probably does as much good as harm, and under some conditions its usefulness is pronounced. A full discussion

The recovery of the bands was reported to the Biological Survey in November by the finders, in the same manner as other information is supplied in connection with the thousands of migratory birds banded by cooperators of the Government Bureau.

Mr. Noak wrote the Biological Survey that he has made a business of raising decoy ducks, and that it is his practice to mark them with aluminum leg bands. He believes that these two birds left with flocks of wild ducks that dropped in at his pond. They were crosses between "English Call" and wild mallards and Mr. Noak thinks that they left either in March or April, 1923.

One was shot at Bear Lake, Minnesota, on October 20, 1923, by Dr. George A. Dodge, of Northwood, Iowa, and the other



FIG. 18. Shorebirds on San Diego Bay. The total protection afforded the frequenters of our shore line makes sights such as this familiar to those who live near favorite feeding grounds. Photograph, January, 1924, by Webb Toms.

of the crow's worth is given in Farmers' Bulletin 1162, *The Crow in Its Relation to Agriculture*, obtainable on application to the United States Department of Agriculture, Washington, D. C.

ORIGIN OF STRANGE BIRD BANDS NOW KNOWN.

Responding to an appeal issued through the sporting periodicals by the Biological Survey of the United States Department of Agriculture for information as to "Who Banded These Ducks," namely, two mallards, a reader of the dispatch has given the information desired.

Charles Noak, of Jennings, Missouri, states that the birds in question probably belonged to him. Both birds, which carried similar aluminum bands marked with the number "13," were killed at widely separated points in the Mississippi Valley.

at Horse Shoe Lake, two miles northeast of Granite City, Illinois, on October 30, 1923, by G. A. Simon.

These records are indicative of the interesting information that is being gathered by the Biological Survey in its investigation of migratory waterfowl by means of numbered aluminum bands. Sportsmen should accordingly report every case that comes to their attention, always being careful to give the date and exact locality where the bird is obtained.

POWER COMPANIES ANXIOUS TO COOPERATE.

Engineers of the various power companies in California meet together regularly to discuss problems looking toward a report on methods and practices relative to power projects on the Pacific Coast. The Fish and Game Commission was

asked to furnish representatives for a meeting held in Los Angeles December 18 and 19, 1923, in order to discuss fishways and screens. Every large power company of the state was represented and a spirit of cooperation, rather than a spirit of antagonism, was very evident. The men there gathered expressed genuine interest in the future of fish in the state and agreed that laws relating to fishways and screens were reasonable. Discussion centered around the best kind of fishway and the most modern type of screen. It was shown that the electric fish stop, so widely advertised, was still in the experimental stage and had not thus far proved effective. To have the power companies

month. The efforts of the department have centered largely around the sheep sections and have aided materially in clearing the lambing grounds of these predatory animals. As the lambing season is now in full progress the hunters are engaged in clearing the territories surrounding the lambing fields.

Predatory animal control work has two main seasons, the winter season being devoted largely to the destruction of the adult animals, while the spring season is devoted to catching the young.

Mr. Poole states that the counties are cooperating very satisfactorily with the government and state in this work and that he now has agreements with twenty-



FIG. 19. Boy scout troop receiving instruction on fish and game conservation in Yosemite, summer, 1923. Instruction in the field is vastly superior to instruction given inside four walls. Summer resort educational work by the Commission is assuring better conservation in the future.

lined up in favor of suitable fishways and screens makes the difficult problem of fish conservation easier to solve.

PREDATORY ANIMAL CONTROL ACTIVITY.

According to Charles G. Poole of the United States Biological Survey, the work of predatory animal control in California progressed very satisfactorily this past winter season.

Mr. Poole is cooperating with the State Department of Agriculture in the control of coyotes, lions, bears, cats, etc. He has between 70 and 80 men in the field, operating from Tulare County to the Oregon line. The reports which he receives indicate that there are approximately 2000 predatory animals killed a

one sheep producing counties. Reports from cattle men and sheep men throughout the state are gratifying and indicate that the control measures are effective in largely decreasing the loss of stock.

GREBES NOT SERIOUSLY DESTRUCTIVE TO FISH.

Grebes have long been numbered among the birds suspected of endangering the supply of certain fishes valued as human food. The charges against these birds, however, have been made without foundation in fact, according to the Biological Survey of the United States Department of Agriculture. To arrive at this conclusion required careful study of the food habits of these birds, both by field observation and by microscopic examination in

the laboratory of the contents of nearly 400 grebe stomachs, collected in various parts of North America. This was made possible during an extensive investigation that has been undertaken of the economic relations of fish-eating birds in general.

The results of the findings, so far as the grebes are concerned, are now published in a new bulletin of the department, prepared by Dr. Alexander Wetmore, of the Biological Survey, under the title, "Food and Economic Relations of North American Grebes." This constitutes the latest addition to the valuable series of reports intended to deal with the economic value of all groups of birds of the United States. Since 1887 formal reports have been issued on the relations to agriculture of more than 200 species of birds, besides shorter accounts of as many others.

In the new bulletin the food habits of six species of grebes are described in detail. It is found that some of these peculiar birds feed on fishes, but on the whole the kinds of fishes eaten are of little or no value to man. Crawfishes and other crustaceans are common food for grebes, and the pied-billed grebe especially is beneficial in localities where crawfishes are destructive to crops. Predacious water beetles and bugs constitute a large part of the food of several species of grebes, which also act as scavengers among the masses of miscellaneous insects found floating on the water. It is a fact of interest that all species of grebes are found to have the peculiar habit of eating quantities of their own feathers though no definite reason for this is at present known.

Before 1903 many thousands of grebes were killed for the sake of their beautiful breast feathers, but when the market for grebe skins was closed this slaughter practically ceased. With increased protection during recent years the birds have regained something of their former abundance. They are not now considered game and are protected by federal law at all seasons.

The purpose of the new publication, Department Bulletin 1196, is to inform sportsmen, legislative committees, and others interested in the protection of birds as to the economic status of the various species of grebes. The bulletin may be obtained, while the supply lasts, by applying to the United States Department of Agriculture at Washington, D. C.

FORMER ADVOCATES OF SPRING SHOOTING NOW APPROVE STAND OF BIOLOGICAL SURVEY.

Perpetuation of hunting as a sport as well as the conservation of game is the

significance back of a letter just received by the Chief of the Biological Survey of the United States Department of Agriculture from a prominent sportsman of Alton, Illinois, in which the writer, acknowledging in true sportsmanlike fashion that he had been wrong and the Biological Survey right, announces conversion from his former pronounced advocacy of spring shooting. The letter, which is typical of many others received by the bureau, contains the following interesting statements:

"The members of our club are all prominent business men of Alton, Illinois. Some of them are enthusiastic duck hunters and at one time were bitterly opposed to the federal laws prohibiting spring duck shooting. But time has demonstrated that we were wrong, and I am safe in saying that 'there is more joy over one sinner that repenteth than over a hundred already in the fold.' I am in a better position to watch the increase of ducks since spring shooting was abolished, and also their fall flights, than most men, for I retired from active business several years ago and now spend most of my time fishing and hunting. Any time I can be of service to you, command me."

The frank and friendly spirit back of the letter shows the fairmindedness of the true sportsman, and at the same time does not attempt to hide the fact that the recent conversion is on practical grounds. Once bitterly opposed to the operation of the federal law, he has become convinced of its necessity by the outcome, and now is as strongly opposed to spring shooting as once he was in favor of it.

A few years ago this correspondent was a member of delegations of hunters from several middle-western states appearing before congressional committees and officials of the Department of Agriculture seeking to change the policy of abolishing spring shooting. The plea then made was that fall shooting was so inadequate that sportsmen were entitled to another season at the time the birds were on their northward way in the spring. Sportsmen throughout the country generally have now come to realize that by a proper conservation of game they are fostering their own best interests. The changing sentiment means not only that wild fowl may now go to their breeding places unmolested, so that the species may be perpetuated by the survivors of fall hunting and of the rigors of the migrations; it means also that the birds, being allowed to enter the breeding season without the spring slaughter, have so increased in

numbers that there is ample shooting in fall.

The policy of the Biological Survey, which has been maintained after a careful study of the migratory bird situation from every angle and after consultation with sportsmen of national reputation, has overcome the two greatest obstacles to the perpetuation of our game birds—the sale of game and spring shooting—both of which are now prohibited throughout the United States. This policy was opposed at the start by some sportsmen of the Mississippi Valley states, chiefly centering in Missouri and Illinois. It was in this area that test cases arose to overthrow the original federal migratory-bird law, and thus it is all the more gratifying to conservationists to find that some of their once most bitter opponents have now become their friends, frankly acknowledging that the stand maintained by the Biological Survey throughout the controversy was right.

VALUABLE FURS SHIPPED FROM ALASKA.

The value of pelts of land fur-bearing animals shipped out of Alaska, as reported to the Biological Survey of the United States Department of Agriculture, during the year 1923, was \$1,794,159.85, the total number exported being 397,287. While this number exceeds that of the previous year by 2040, the value is \$5,127.55 less, because of the lower prices paid for some kinds of furs. As usual, the muskrat exceeded all others both in numbers and in total value of skins, 319,611 of these, having a value of \$367,552, being the year's export. Next in order come the white fox, numbering 7939, with a value of \$297,476; the beaver, with 14,341 skins, worth \$258,138, and the red fox, with 10,787 skins, valued at \$215,740. The most notable decrease as compared with 1922 is the mink, 31,983 of these skins being shipped that year and 20,668 in 1923. The most notable increase is the red fox, 5979 skins being exported in 1922 and 10,787 in 1923.

BUFFALO MEAT SENT TO WASHINGTON.

Threatened extinction of the buffalo has not only been averted, but the number of these big animals have so increased that occasionally buffalo steak may be had at city markets or at hotels and restaurants, according to the Biological Survey of the United States Department of Agriculture.

Shipments of surplus animals have already been made from the National Bison Range, in Montana, to points in Montana,

Idaho, and in the State of Washington, and recently one went as far east as St. Paul, Minn. To learn something of the possibilities of longer shipments, so that all parts of the country may enjoy as a delicacy what was once the ordinary food of the early frontiersman, half a buffalo carcass was frozen at a plant of Ronan, Montana, in February, and sent to Secretary of Agriculture Wallace at Washington, D. C. The Department of Agriculture is interested in the quality of this meat and how it will best stand shipment from western ranges to the eastern markets.

During the days of the early settlement of the country the great slaughter of buffalo for their meat and hides brought these big game animals to the verge of extinction. A few animals were usually to be found in zoological gardens, but herds of buffalo require vast ranges. Steps were taken some years ago to preserve herds for future generations from the remnant left in the country and a number of suitable places were selected and set aside for the animals both as private preserves and as governmental ranges.

The total number of buffalo now in the United States is about 4500, of which more than 1600 are nationally owned and divided into nine herds. One of the largest of these herds is maintained by the Biological Survey of the United States Department of Agriculture, on the Montana National Bison Range, an 18,000-acre pasture on the Northern Pacific Railroad, near the town of Dixon, in western Montana. The original herd of forty animals placed there was presented to the National Government by the American Bison Society, and came chiefly from the Conrad herd, near Kalispell, Montana, the Corbin herd, in New Hampshire, with one from the Goodnight herd in Texas. The excellent forage on this extensive national reservation, together with ideal natural conditions for the animals, has now resulted in an increase of the herd beyond the food capacity of the range. As the buffalo, elk, and other big game animals of the Bison Range continue to increase it has been found necessary to plan for the disposal of the surplus, in order that those kept in the inclosure may have sufficient food and room to range. Accordingly, last fall a number of the surplus animals were killed and shipped to local and other markets.

The full-blooded buffalo in North America now number nearly or quite 15,000, according to the most recent information received by the Biological Survey, from points in Canada, Mexico, and

the United States. We can therefore rest assured of the perpetuation of these interesting animals, with an ample supply for exhibition and breeding purposes and a surplus each year to be marketed for meat, heads for mounting, and robes.

The annual increase on the National Bison Range alone is about 100 animals,

and as the limits of the available forage on this refuge have now been reached, it will be necessary hereafter to dispose of a surplus each year. While some will be marketed as meat, heads, and hides, a number will undoubtedly go to parks and zoological gardens for exhibition and breeding purposes.

FACTS OF CURRENT INTEREST.

To amicably settle the Fish and Game Commission's financial status under the budget law, mandamus proceedings were instituted and a hearing was held by the Supreme Court on March 13.



According to reports of deputies, an unusually large toll of ducks was taken in the Sacramento Valley during the last open season.



The Commission is supporting the move to reestablish Lower Klamath Lake as a breeding grounds for ducks. The lake was drained a few years ago in the hope of furnishing valuable agricultural land. The experience here should emphasize the necessity of more careful investigation before drainage projects are consummated.



The violation of law as regards the use of food fish in reduction plants has become acute in late months and has occupied the attention of the Commercial Fisheries Department.



Increasing demand for lectures by Kiwanis, Rotary and Lions clubs are reported by the Education and Publicity Department.

Every school child in the whole city often is turned out to see the Commission's educational films. Such was the case during January at a display held at Tracy, San Joaquin County.



The salmon investigation is revealing the first definite information as to the habits and food of year-old salmon in the ocean. That the future of salmon may be menaced by the bait fishermen along the coast has also been demonstrated.



With the opening of the trout season on May 1 every angler should remember that low water conditions menace fish life and he should gauge his activities accordingly.

HATCHERY NOTES.

W. H. SHEBLEY, Editor.

LOW WATER ENDANGERS FISH LIFE.

Reports from Santa Cruz County indicate that most of the streams used for spawning by the steelhead trout are carrying so little water that the fish are unable to enter the mouths of the streams. The few that succeed in following up a stream after a late spring rain die soon after the run-off which leaves almost a dry streambed. Many dead steelhead are reported

head in a half a mile of stream. The fish were uniformly large spawning fish and several which were cut open disclosed that they had been unable to spawn before death overtook them.

Conditions in the lower Pajaro River are such as to give an easy explanation of the death of these fish. Sewage containing chemicals from a spray manufacturing plant and soapy water from a

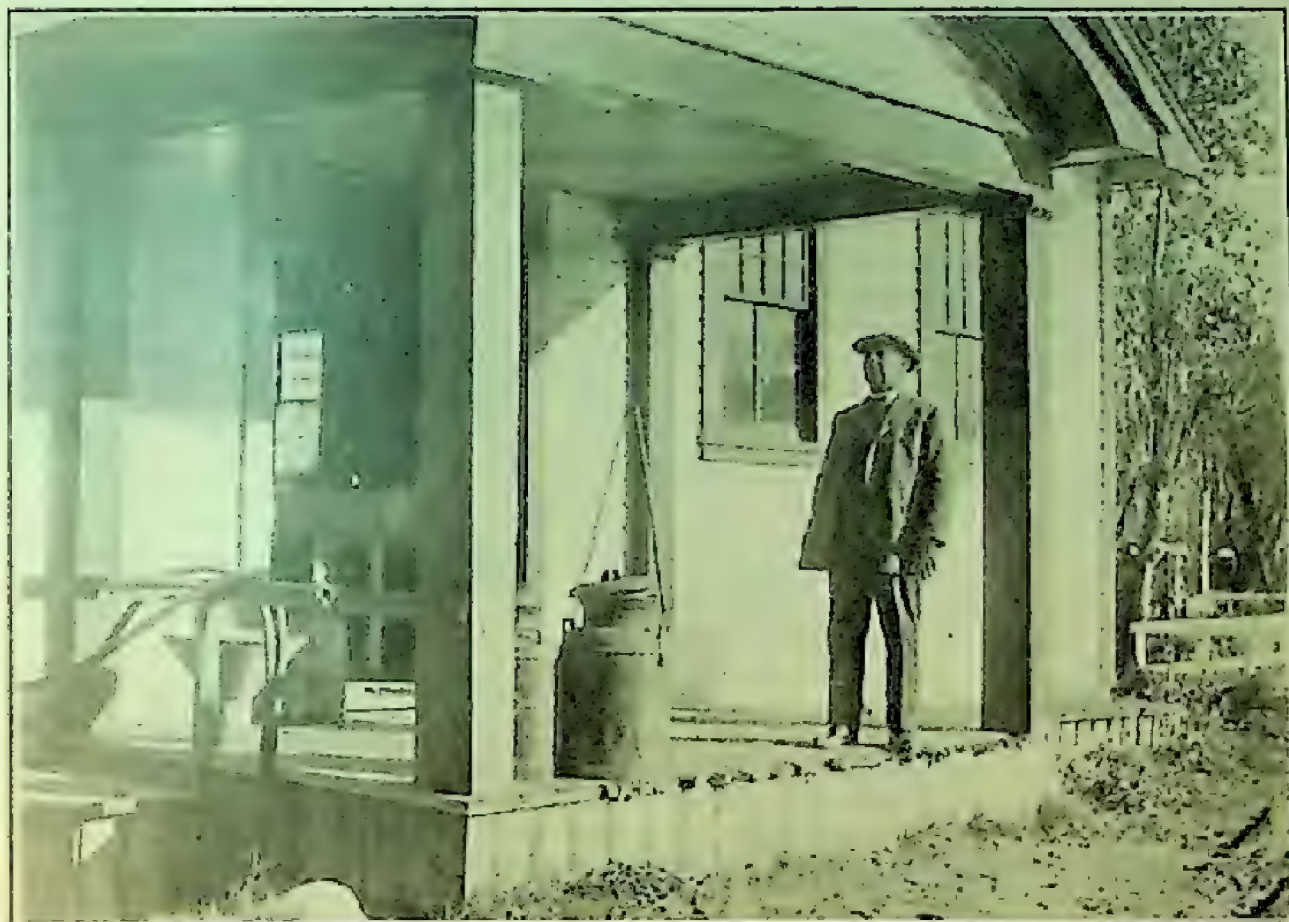


FIG. 20. Captain G. H. Lambson, Superintendent of the Mount Shasta Hatchery and Klamath River stations, a man who has immediate supervision of the hatching and rearing of the greater proportion of the millions of trout and salmon that leave the state's hatcheries each year.

along the San Lorenzo and the Pajaro rivers.

STEELHEAD CONDITIONS ON THE PAJARO RIVER.

A few steelhead have been able to enter the mouth of the Pajaro River, but with consequent dire results. Mr. Foster, who lives about a mile from the mouth of the river, reported that he counted thirty-six dead steelhead inside of 500 yards. A visit to the lower portion of the river on March 6 disclosed sixty-one dead steel-

laundry causes the worst type of pollution when there is insufficient water to carry the sewage into the bay. At times the river is milky white in color as a result of this pollution. To anyone visiting the stream, it seems incredible that any steelhead could survive after passing through the necessary three miles of a stream so grossly polluted before reaching clear water. There may be some sorts of fish which can adapt themselves to such conditions, but certainly the steelhead is not one of them.

STEELHEAD OPERATIONS IN SANTA CRUZ COUNTY.

Up to March 10, 750,000 eggs had been secured at the Scott Creek Spawning Station in Santa Cruz County. Sufficient fish were being held in the tanks to furnish as many more, so that a take of at least a million and a half eggs is to be expected.

BLACK BASS ENDANGER TROUT ANGLING.

Numerous factors are concerned in the depletion to be noted in many streams where angling is now on the decline. Sportsmen are naturally disturbed over conditions. However, instead of attempting to improve the trout fishing by some sane conservation measures, as, for instance, increased protection for spawning steelhead, they immediately demand the introduction of some other fish, failing to realize that there is no fresh water fishing so attractive to the majority as is trout fishing. The usual demand is for the planting of black bass. Nothing injures trout fishing more unless perhaps the introduction of so predatory a fish as the gar pike. In every instance in California where black bass have been introduced into a lake where trout angling was formerly enjoyed, there has been a rapid disappearance of the trout. Whereas there is nearly always a chance to capture at least a few trout in trout waters, the black bass is not so dependable—biting well on certain days and refusing absolutely to take the angler's bait on other days.

A warning is here issued to every angler in the state regarding this popular demand. Save all trout streams and lakes for trout fishing, since this is the most popular type of angling. Plant reservoirs which do not contain trout with bass, thus supplying an additional resource rather than supplanting one.

DROUGHT MENACES TROUT STREAMS.

That fishing interests are seriously menaced on account of the drouth does not seem to be so well understood by the public as is the effect upon agricultural, horticultural and dairying interests; but in reality present drought conditions will greatly curtail the fishcultural activities of the Commission and increase the difficulties and problems confronting that department. Not only will it be impossible to provide the normal amount of fishing, but it will also be out of the question to stock new streams. Indeed, in many places it will be a problem to maintain sufficient stocks of fish to assure a normal supply for another season.

If the drought continues it appears that many of the smaller streams will dry up entirely and numbers of the fish in them will perish. In other instances, it will be necessary to divert and impound for irrigation the waters of a number of streams, which will mean further losses.

From present indications, the take of eggs this year will amount to only about half of the number taken last year. At Cape Horn Dam on the south fork of Eel River, not a single egg will be taken this season, as the small amount of water now running in the river above the Gravelly Valley Dam is all being impounded for irrigation. This same condition prevails in other parts of the state. At the Domingo Springs Egg-collecting Station, where early in March the snow is usually from four to ten feet in depth, this year at the same time the roads in the vicinity of Chester were dusty and only a few patches of snow remained in the deep timber on the high altitudes. The streams are as low as they usually are in the month of August. If fishing for the limit is allowed to continue, the task of restocking streams throughout the state will be almost impossible of accomplishment.

COMMERCIAL FISHERY NOTES.

N. B. SCOFIELD, Editor.

FISHERIES OF CALIFORNIA, 1922.

The catch of fish taken in the waters of California in 1922 amounted to 168,969,733 pounds, compared with 127,728,623 pounds the previous year, an increase of 41,241,110 pounds, or 32.28 per cent. The species taken in largest quantities were pilchards, 93,399,900 pounds; albacore and tuna, 17,920,019 pounds; flounders, 11,341,262 pounds; bonito, or skipjack, 10,998,855 pounds; salmon, 7,235,124 pounds; barracuda, 4,710,753 pounds; rockfishes, 4,238,480 pounds; yellowtail,

3,111,198 pounds; mackerel, 2,466,762 pounds; white sea bass, or squeteague, 2,195,932 pounds; abalones, 1,523,394 pounds; and shad, 1,109,445 pounds.

The imports of fish from Mexico in 1922 amounted to 12,146,066 pounds, as compared with 6,699,817 pounds the previous year. The principal species imported were albacore and tuna, 6,179,754 pounds; barracuda, 1,528,770 pounds; bonito, or skipjack, 1,792,592 pounds; flounders, 817,304 pounds; white sea bass, or squeteague, 736,220 pounds; sea crawfish, or

spiny lobster, 640,466 pounds; and yellow-tail, 303,292 pounds.—Annual Report of the Commissioner of Fisheries for the fiscal year ended June 30, 1923.

STEELHEAD CAUGHT OFF MONTEREY WHARF.

This winter has furnished the anglers of Monterey municipal wharf with an excitement new in their experience. Steelhead "salmon," or trout, as you prefer, have been taken plentifully for a couple of months with hook and line from the wharf. It is not new to see an occasional steelhead swimming about the wharf, but this is the first time, within recent years at least, that this choice fish would take the hook near the wharf with its rumbling trucks and grumbling anglers. The explanation is probably to be found in the fact that the dry winter has provided the local streams with so little water that steelhead could not run up to spawn. The local streams, like many others of the state, are frequently dammed at the mouth with sand bars and it is a practice among sportsmen and others interested in fish to open the bars by digging out a channel, thus allowing the fish to enter the streams. This winter no one has wasted his energy opening the bars to admit the fat steelhead to a dry stream bed. Even the selfish wharf anglers would accept more rain without protest.—W. L. SCOFIELD.

MACKEREL AT MONTEREY.

Market fishing for mackerel has been carried on at Monterey for at least fifty years, but it has not been very extensive until recently. A few years ago there was a period of slump when mackerel were rather scarce, but for the past two or three years the Monterey market has been supplied abundantly and with fair regularity. At present some twenty boats make mackerel fishing their chief occupation and this small fleet is to be seen almost every morning two or three miles off the southern shore of Monterey Bay. The fishermen use hand lines and sardine bait after chumming up the mackerel by throwing out minced sardines that have been run through a meat grinder. In addition the sardine fishermen using the lampara net (a highly specialized large net working somewhat on the purse net principle) occasionally make large catches of mackerel in their nets, hauls of several tons at one time being common. Such catches flood the market temporarily and the excess that can not be absorbed by the fresh market is usually salted down. Most of the Monterey mackerel is shipped

fresh to markets in the state, principally San Francisco, but some are split and salted down and occasionally small quantities are dried.

Two species are now taken in quantity, the most abundant being the common Pacific coast mackerel with zebra stripes (*Scomber japonicus*), variously known as "Black," "Tinker" and "Timkin." The name most frequently used at Monterey is Spanish mackerel, but this is unfortunate as it leads to confusion with the Spanish mackerel (*Scomberomorus sierra*) and the Monterey Spanish mackerel (*Scomberomorus concolor*). For an interesting account of these two last named fish, as well as of all the mackerel-like fishes found on our coast, see the article by E. C. Starks in the July, 1918, CALIFORNIA FISH AND GAME, Vol. 4, page 118.

The other species commonly taken at Monterey is the horse mackerel (*Trachurus symmetricus*), a fish that has been considered very inferior, and in past years was not taken in quantity because there was either no sale for it or the price was so low as to leave little profit in handling it. In the last two or three years there has been an unexpected development in the mackerel fishery. It has been discovered that the people of Latin races and orientals, especially Chinese, living in the state are very fond of the horse mackerel and are willing to pay an advanced price for it, so that now (Feb. 1924) the sale value of the two mackerels has been completely reversed. The choice black or zebra striped mackerel is sold by the fishermen at 4 cents per pound in the round, and the horse mackerel, formerly held in such contempt, is sold at 8 cents—W. L. SCOFIELD.

STRIPED BASS NUMEROUS IN SAN JOAQUIN RIVER.

Deputy Fish and Game Commissioner J. E. Newsome, who lives at Newman, reports that during the last year more striped bass were taken in that part of the San Joaquin, near where he lives, than he has ever known. During the commercial closed season during May, June and July anglers would get their limit of five bass almost daily at Newman and Crows Landing. Dozens of anglers fished daily from the Crows Landing bridge and several told him they were getting their limit each day. These bass ran from three to thirty-five pounds. In 1922 there were a good many in that part of the river, but not so many as last year. A few years ago they were scarce. Like conditions were reported for the upper part of Napa River by Deputy Commissioner W. J. Moore of Napa.

HOW TO TELL WHEN FISH IS STALE AND UNFIT FOR FOOD.

Animal foods, unless they are preserved, soon start to decompose and finally become unfit to eat. Fish are no exception to this rule and unless they are preserved by ice or by salt, deteriorate rather rapidly. We are frequently asked how one can determine when a fish has passed from the state when it can be called fresh and when it becomes unfit for food. Occasionally deputies of the Fish and Game Commission are called upon to decide disputes in cases where deliveries of fish have been rejected. In commercial practice, fish handlers and buyers become expert in determining the condition of fish from their appearance and odor but usually they are unable to give any general rules which may be followed by others.

In an effort to formulate some rules for determining the state of decomposition in fish an investigation was undertaken by Dr. A. G. Anderson, a scientific assistant to the Medical Officer of Health, Aberdeen, Scotland. His full report is to be found in the Annual Report of the Fisheries Board of Scotland for the year 1907. His summary of methods of determining decomposition we give here somewhat abbreviated and with a few explanatory clauses of our own in brackets. He believes the following five tests are fairly reliable in giving evidence of the condition of a fish.

1. The presence or absence of rigor mortis.
2. The presence, degree of development of, or absence of, reddish discoloration of the ventral aspect of the backbone.
3. The smell.
4. The manner in which the flesh separates from the backbone.
5. The appearance of the abdominal walls.

I. So long as a fish is in the condition of rigor mortis it is a guarantee that it is perfectly fresh, since decomposition can set in only as rigor mortis passes off. The ordinary tests for rigor mortis are: Degree of rigidity on handling, firmness and elasticity of flesh and absence of pitting readily on pressure. (The flesh of the body near the tail retains its firmness longest.) The chemical changes in the muscles are important during rigor mortis. The tissues become alkaline as rigor passes off, and finally distinctly alkaline when decomposition has set in. Both may be determined by litmus paper. Rigor mortis is of short duration and its absence is no guarantee that fish is not sufficiently fresh and not fit for human food.

II. At this stage the presence or absence of reddish discoloration on the ventral side of the backbone is invaluable and should be looked for. (This discoloration should be looked for in the flesh of the tail lying next to and just below that part of the backbone between the body cavity and the tail fin. This should not be confused with the kidney, which has the appearance of clotted blood and extends the length of the body cavity lying just beneath the backbone.) If it is present, we know that the fish are certainly not fresh. The time will probably be about forty-eight to sixty hours after capture or after landing. But even at this stage the fish may not be such as should be condemned as unfit for human food or for curing purposes. Yet, when one sees this discoloration fully developed, it should make one suspicious and more cautious as regards the condition and cause one to examine them more critically by further tests.

III. [The author speaks of the difficulty in describing the different degrees and qualities of odor in different classes of fish and the different degrees of development of the sense of smell in different individuals] yet the test of smell is both a time-honored and a reliable standard. One will usually find that, as the red discoloration is appearing, the smell is passing from fresh to tainted and stale. The fish is now on the borderland, and one smells critically for an approaching putrid odor, when the fish should be at once condemned.

IV. When a fish is fresh it requires considerable pressure to strip the flesh from the backbone and in doing so many tags of flesh are left adhering to the bone. As decomposition, and consequently softening, progresses, the flesh gradually strips off cleaner. Hence, when one finds that the flesh comes away readily and comparatively cleanly from the bone, or that the bone can be stripped readily and cleanly from the flesh, one may feel convinced that the fish are certainly not fresh, that decomposition, if not well advanced, has certainly commenced, and by this and other tests proposed one will feel warranted in condemning such fish.

V. Note the condition of the abdominal walls. If they are firm and elastic, with absence of discoloration and presence of fresh, characteristic smell, one may feel assured that the fish are fresh. On the other hand, if the walls are soft and pulpy, with apple-jelly-like appearance, and presence of discoloration, with tainted odor, while the fish is becoming alkaline to litmus paper, then such fish

require very careful consideration, and it will generally be found that, with other confirmatory evidence present, such fish should be condemned.

Other common tests which should never be omitted are:

VI. The appearance of the gills. The gills of most fish are red in color, with certain specific tints. These tints disappear in from twenty-four to thirty-six hours, and the gills become grey and slimy by the third to fourth day. So long as the gills retain their natural color there is a strong presumption that the fish are fresh. But one has to keep in view that the gills often retain their characteristic color with little change—especially if washed daily in tap or, still more, sea water—even when the flesh is becoming putrid; also that one finds degrees of paleness even among perfectly fresh fish.

VII. The appearance of the eye. The appearance of the eye should always be noted. The full and prominent eye, with the jet-black pupil and transparent cornea of the fresh fish presents a very decided contrast to the grey and shrunken eye of a fish four or five days after capture.

VIII. The appearance of the scales. One notes the absence or presence of characteristic sheen, the firmness or looseness of the scales, and if they rub off readily. If the scales present a patchy appearance it indicates that the fish are probably trowled or have been roughly handled.

From the above considerations, the author ventures to state that when:

1. Rigor mortis has passed off;
2. Reddish discoloration is fully developed as described;
3. Flesh smells tainted, passing to putrid;
4. Flesh strips off readily and cleanly from backbone;
5. Abdominal walls become soft and pulpy, with commencing apple-jelly-like appearance and with commencing discoloration and tainted odor;

6. Gills lose characteristic tint, becoming grey and slimy;

7. Eyes are grey and shrunken; such fish should unhesitatingly be condemned.

SAYS VESSELS CAN PREVENT OIL POLLUTION.

The pollution of harbors through the discharge from ocean steamers of oil-fouled bilge-water can be prevented if the vessels are equipped with modern appliances, according to A. S. Goldsborough, secretary of the Baltimore Merchants' and Manufacturers' Association, which is now investigating the depletion of oyster beds in Chesapeake Bay. Mr. Goldsborough recently investigated a German steamer in Baltimore harbor, which, he says, was equipped with the latest devices. Later he gave out the following statement.

"In connection with the investigation being made by our association with the view of seeing if the problem of pollution is susceptible of solution, I visited one of the German steamers now in the Baltimore harbor. This vessel is one recently arrived here from Germany and is of the latest type.

"By reason of the fact that Germany, by law, forbids the pollution of her harbors through the discharge of oil impregnated bilge-water, the up-to-date oil burning steamers are equipping themselves with effective devices to separate the water from the oil.

"The full details of the separating process were thoroughly explained and the superb efficiency of the vessel's machinery for this work frankly disclosed. The fact that the separation and clarification are easily possible and at a reasonable cost was clearly demonstrated.

"Inasmuch as the equipment of vessels with these mechanical processes would lay the basis for control, the first step should be the development of regulations and enforcement acts which would stop the discharge of any of the bilge-water in the rivers, bays and harbors."—*Fishing Gazette*.

NOTES FROM THE STATE FISHERIES LABORATORY.

WILL F. THOMPSON, Editor.

THE STATE FISHERIES LABORATORY.

The investigators at the State Fisheries Laboratory in San Pedro are, with the exception of the writer (Mr. W. L. Scofield is stationed at Monterey) new employees of the Commission. In Miss Clark's place is Miss Ruth Miller; in

that of Mr. Higgins is Mr. Wilbur Selle; in that of Mr. Sette is Mr. Harold Greene. These three are all undergraduate students—no graduates being available—from colleges and universities. The change from trained to untrained investigators might at first glance seem disastrous, and it is the purpose of this

article to throw a more optimistic light on the situation.

In considering the effect of this replacement of employees, it must be remembered that highly technical knowledge and training is necessary for the carrying on of scientific research work. Before the new students can acquire this technical knowledge a very considerable period of time must be taken up by training. They do not have, at present, the knowledge, the training, or the experience which fits them to grasp the nature of the problems involved, nor the methods to be followed. It can not, therefore, be expected that they will do much productive independent work at first, and it is equally to be expected that a great deal of time will be used in directing their studies and what routine work they can do.

It is, furthermore, fully to be expected that students will leave the service of the Commission as soon as, or before, they are fully trained. The salaries paid are entirely inadequate for technical experts, although very good for students, and the advancement of these salaries has seemed nearly impossible in the past. Since all governmental scientific work everywhere suffers from these same disabilities, it would seem to the writer that it would be best to accept them, and to so alter the program of work as to accommodate this enormous "turnover" of scientific "labor."

There are certain advantages which compensate for the accompanying great impairment of the laboratory efficiency. Thus the current criticism of the government scientific work is that the poor salaries paid retain the poorer class of scientists, who simply fall into ruts and stay there. And, indeed, one may extend this criticism very justly and say that under governments, a "job" is ordinarily so secure that men would fall into ruts and stay there regardless of the scale of pay. There is, to avoid this, the single alternative of getting good men while they are young, enthusiastic, and necessarily content to take small salaries, with the understanding that their term of service will cease automatically when they become well trained graduates. It is the writer's opinion that the State Fisheries Laboratory must, whether it will or not, be run on this plan, if it desires to retain any virility at all.

There is another advantage in this plan which must not be overlooked. The formulation of a scientific program of investigation requires, besides a definite continuity, a freshness and vitality of

interest which does not flourish well when surrounded and suppressed by conservative scientific job holders. There is nothing like contact with fresh student enthusiasm to keep a director alive and interested. The breadth which his instruction of his helpers must take, the rethinking of fundamentals, the repeated contacts with new points of view, and the relationships which he must establish with universities and colleges, are vital to him and may to some extent reconcile him to his situation. At the foundation of the great majority of good scientists' work, or behind that of the most far-sighted executives in charge of scientific work, lies this contact with schools and teachers, if the writer's observation may be trusted.

There is a third advantage which can not be overlooked. The laboratory will, if such a use of students be continued, be a training school for fisheries investigators who will, as they go out as instructors in colleges and universities, or as investigators for other governments, continue their interest in fisheries and further the advance of our knowledge along that line. And the sound principles upon which our work here is based will be of vast importance. In this sense, the laboratory will be undertaking "conservation by education," in a far-reaching way indeed, and as an institution of the state should. There is no better way to educate the public to the problems of the fisheries.

It is, undoubtedly, rather a startling thing to adopt such a plan, yet it is the only reasonable one, and upon second reflection, the only really startling thing about it is that it has not been adopted by governments before.

It is, therefore, the deliberate recommendation of the writer that the best interests of our scientific work will be served by the employment of these young, interested and energetic students under an agreement strictly limiting their stay. But that a complete turnover in personnel should occur each year is "laying it on too thick," in very truth. Were but one of the older employees at San Pedro retained until some one of the present students could take his place, the continuity of the work would not be interrupted in any real way, as it is now. The departure of Mr. Sette, the last of the three to go, was a real calamity, even though he did go to a much better and bigger position. It is to be hoped that our fortune will be better in the future, although matters are not bad even now. —W. F. T.

THE LIBRARY OF THE STATE
FISHERIES LABORATORY.

Knowledge of our marine fisheries is not far advanced. The Fish and Game Commission is pioneering when it attempts to secure the knowledge upon which rational regulation must be based, and that facts should be understood. The basic principles of such regulation are so frequently misjudged and misapplied by our citizens and lawmakers that a scientist must be skeptical of the real merit of the vastly greater part of our now existing laws dealing with marine fisheries. But in his skepticism, he finds himself too often unable to substitute the correct for the erroneous procedure. He can aid only when he is allowed to set to work discovering what the correct method of control should be. That is just another way of saying that the scientist must carry on research to find the truth. And in encouraging an enlightened effort of that kind, it is vital that those in authority appreciate the fundamental necessities for its success.

In undertaking research of any kind, on any subject, whether the research is for a great industrial firm, for the government, or for a university, the very first and most vital need is a library. Without a library research is futile and useless, for it merely discovers what has been known before. Without a library, all the costly mistakes of men who have worked on the subject will be repeated. Without a library, all that men have discovered in other lines can not be applied to the subject investigated, and in these days some knowledge, however limited, exists concerning almost anything which might be needed, either physical or biological. So that it is and has been the universal experience that where unknown things must be investigated efficiently, and to any extent, there arise, inevitably, libraries; and that where great libraries exist, there centers the best research.

An instance is the modern university. The library is the soul of its capacity for research, the source of the great authority and prestige for knowledge that its professors enjoy, and the library is the reason that the best highly trained technical men, such as engineers and chemists, come from universities. The library is, indeed, the test of a university, for if, in any field

of teaching, or research, the technical library is lacking, in that division of its work at least, instruction and knowledge are of second grade.

In our laboratory at San Pedro research of advanced nature is necessarily carried on, and for its success the library must be adequately and generously supported. There is no fisheries library available which specializes on those things necessary for this research. The library of the University of California is a splendid one, but has not specialized on fisheries, and as our research is specialized, so must our library be a specialized one.

Yet, it is worth while to consider rather carefully what its scope must be. A highly technical and specialized library is not usable without much that seems, to the onlooker, superfluous. For instance, what does a scientific paper on the fishes of the Baltic have to do with our fishes in California? In answer, one might ask whether the principles that govern the smelting of iron ore in Germany do not apply to the smelting of iron ore in the United States. And it might be asked, why do we buy a book upon the minute crustacea that dwell in the Mediterranean? And again, in answer, we may say that principles of fishery research will be evolved from the consideration of just such minute and foreign organisms. These principles are based, for another instance, upon experiments regarding the effects of temperature upon the growth of fishes in aquaria, of clams in the beaches, of pines in Norway, and may possibly be traced in their bearings to the influence of sun spots upon weather. In short, the research man must be free, and have the library and the tools to range anywhere the trail leads. His library must specialize in his needs, not in the field the casual onlooker thinks is the proper one.

It is the hope of the members of the staff of the laboratory that the library will be built up along these lines. So new is the fishery field, and so limited the published work, that there is little fear that the library will ever be a great or expensive one. But it must be free to expand as it can, and wherever it needs must, and if it is thus free, then we may hope to see, some day, the laboratory definitely in the lead of fishery research in America. It is, just now, not a difficult or expensive goal.—W. F. T.

THE SCOTTISH FISHERY BOARD.

In a recent address, the chairman of the Scottish Fishery Board made a statement of the ideals and functions of that board which may well be of interest to us in California. Being, as they are, vitally concerned with the prosperity of the fisheries of the North Sea and of the northern European waters generally, their program has been of necessity carefully considered in the light of experience. The value of the annual catch landed in Scotland is twenty millions of dollars, and the capital invested in the industry is fifty millions. It is therefore of considerable significance that their attitude should be so nearly ours. We can not help but feel that very considerable moral support for our investigations comes to us from the similarity of our ideals and aims with those of this much greater and far-renowned organization. The following quotations are taken from the address as printed in *The Fishing News*, Aberdeen:

"The board's system of statistics going back to 1809 has been described by an eminent authority (Dr. Johnstone, professor of Oceanography at Liverpool) as furnishing a mass of information of the utmost value, not only to those engaged in the administration of the Scottish fisheries, but to those investigating general questions relating to the industry, and as being the most elaborate and complete system by any fisheries authority, while, as regards its administration generally—I hope I may be pardoned for quoting an English writer in the *Quarterly Review*, who concluded an article on the Sea Fisheries of the United Kingdom by saying that—'Their reports are a clear and illuminating guide to the progress of the fisheries of the nation, and the administration is a model to the rest of the world.' In such an industry statistics are of vital importance, as all regulative measures must of necessity be founded upon them and upon ascertained scientific data. * * *

"The scarcity of fish of all kinds in the North Sea is due to various causes, but chiefly to the increased and more efficient catching power and to recent poor spawning seasons, the sea, like the land, having its good and bad breeding periods. Science, in so far as we are concerned, is employed chiefly in the solution of the

practical problems of the industry, and a good deal of light is gradually being thrown on the secrets of the sea. For instance, it is now generally accepted that the age of certain of our fishes can be determined by the number of rings on their scales, while in others it is ascertained from the number of rings on the otoliths, or small stones, present in the ear of the fish. In this way it is possible to ascertain what proportion of fish of a certain age is present in the catches, and what years have been good or bad spawning years, and to predict, to a certain extent, what may be expected in the years to come.

"Temperature and salinity of the water, currents, abundance or otherwise of the minute forms of life on which fishes feed, are other factors which contribute to productivity, and these are among the questions which are engaging the attention of our scientific staff. Coordination in the investigations is secured and overlapping avoided by periodical conferences between the marine biologists employed by the different North Sea powers, and uniformity of regulations when shown to be necessary for the conservation of the stock is also assured. That certain varieties, and particularly flat fish, can be depleted has been conclusively demonstrated, and it is therefore vital to the future of the industry that a close watch be kept on developments, so that any necessary measures of protection may be adopted and put in force."

There is nothing in this address with which we can not heartily agree, and a comparison with our own program calls forth only the following comment:

Our own system of fishery statistics is, we believe, fully as elaborate and complete as those of the Scottish fishery board, with the natural differences and limitations which arise because of the smaller boats used in California. Our work has, however, not been established for sufficient time to gain the recognition it will have.

The investigations of the Scottish fishery board upon the physical condition of the sea, mentioned in the address quoted, has not been paralleled in California because of the expense of such work, and because it is not of such immediate importance in the regulation of the fisheries. —W. F. T.

LIFE HISTORY NOTES.

SHOREBIRDS INFESTED WITH
INTESTINAL PARASITES.

During September, 1923, I found numbers of dead shorebirds with some sort of an intestinal parasite, on the shores of Morro Bay, San Luis Obispo County. A specimen of a western willet sent to the Bureau of Animal Industry of the United States Department of Agriculture brought the report from W. G. Houck that the specimen contained "numerous thorn-headed worms (*Acanthocephala*) in the intestine. These were responsible for the nodules in the intestinal wall. The larvæ and embryos of the worm live encysted in the larvæ pupas and bodies of

the two sheep has been running with the goats for about two years. The other one, which is shown in the picture tied in the meadow, has been with this same herd of goats for about six months. Both sheep are coming 3 years old. The ram shown in the picture as running directly with the herd of goats is the very tame one, and it seems to be quite proud of being given attention or petted by its Indian owners.

When the herd of goats comes off the mountain range to the little ranch or base camp, it is the custom to shut the goats up in a corral every night and the little sheep seem to be perfectly contented to

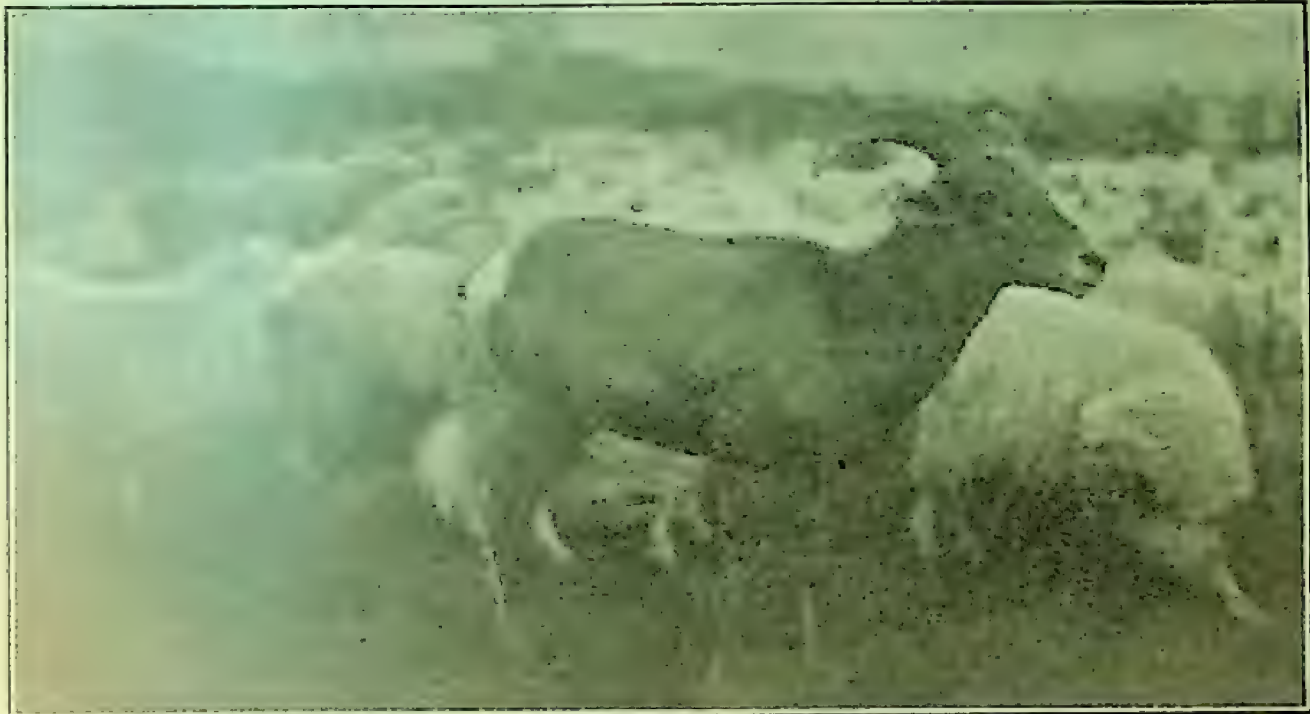


FIG. 21. Desert mountain sheep which makes himself at home among a flock of goats in the Panamint Mountains of Inyo County. Photograph by E. H. Ober.

certain insects. Birds become infested through eating the insects in any of these stages."

In the examination of many of these shorebirds I found the intestinal walls were perforated and a mass of worms were found in the abdominal cavity.—Allan Brooks, Okanagan Landing, British Columbia.

TAME DESERT MOUNTAIN SHEEP.

Recently, a couple of mountain sheep have been running with a flock of goats in the Panamint Mountains of Inyo County. Both animals are rams and one of them is so tame that it can be petted and will actually eat out of one's hand. The other one is a little shy but is becoming more and more tame. The tamest of

go right along with them. The Indians live in a little shack of a house some little distance from where the goats are corraled, and every morning about breakfast time the Indians will come out and call to the tamest sheep by beating on a tin pan and calling aloud its name. The sheep will immediately jump with ease over a fence four feet high and come running and bounding to the house, where it is usually given hot cakes or crusts of bread. It will, in fact, eat most anything it is given, but seems to prefer sour dough hot cakes.

Both of the rams are tremendous fighters and seem to enjoy knocking over old billy goats twice their own size. This fact so impressed me that I asked the Indians to name the largest of the two

sheep after the world's greatest fighter, Jack Dempsey.

The Indians have been cautioned to watch the sheep particularly during the rutting season, since at that time they are apt to wander off. However, the Indians are very much attached to the sheep and will doubtless do everything possible for their protection.—E. H. Ober, Big Pine, California.

DEER CONDITIONS IN REFUGE 1-D.

The following letter under date of January 24, from W. T. Shock, a trapper of the Biological Survey, shows the condition of the deer within the Refuge 1-D within the Trinity Forest, as well as the predatory animal situation:

begin using the licks. There being no snow in the high mountains, the deer are all high on the slopes and not along the rivers. There are plenty of deer in Logan and North Fork gulches and in the short brush along Manzanita Creek. The deer are in fine condition.

My report of deer killed within the Refuge 1-D by predatory animals since November 15, 1923, is as follows: Ten by bobcats, twenty showing coyote work, one by an eagle, and one by a mountain lion.

I have covered nearly all of the refuge north of the Big Creek Divide."

Investigations made by forest officers on the Trinity Forest bear out the statements of Mr. Shock in that, due to favor-



FIG. 22. Desert mountain sheep tamed by herders in the Panamint Mountains of Inyo County. Photograph by E. H. Ober.

"I have trapped twelve coyotes and caught ten bobcats with my dogs. Most of the cats were caught within the refuge along the highway between Helena and Big Bar. Five of the cats were caught from the carcasses of deer that they had killed in the refuge. I have used poison and have found thirty poison baits taken by coyotes and I am satisfied that I have killed that number with poison since I came to North Fork.

A general poison campaign west of the Trinity River, and in the game refuge, would be the only means to kill out what coyotes are left in that part of the refuge.

I would suggest March or April for this campaign, or even, say after the deer

able weather conditions of the present winter, deer are not gathering on the lower slopes along the rivers, but are found well distributed over the high slopes and appear to be in fine condition.—J. W. Nelson, Assistant District Forester, San Francisco.

COYOTES DAMAGE FRUIT CROPS IN SOUTHERN CALIFORNIA.

The Director of Agriculture has just received a report from Norman G. Buhn, superintendent of rodent control, and Chas. G. Poole of the U. S. Biological Survey, who have recently returned from southern California, in which it is shown that coyotes have done considerable damage to melon and grape crops in several

sections of southern California. In one instance in the Morino Valley, Riverside County, these animals cleaned up the entire crop of melons. On a forty-acre field in another section of the valley, considerable loss was occasioned by the ravages of coyotes. Many additional acres will be planted this spring to melons and the district has called upon the State Department of Agriculture and the local horticultural authorities to institute a campaign against these animals.

The principal articles of food of coyotes which directly affect farm operations are

chickens, turkeys and other small farm animals, melons, grapes, figs, prunes, and a variety of other fruits. Coyotes have frequently been known to take practically every bunch of grapes on small vineyards.

The Department of Agriculture, in cooperation with the county horticultural commissioner of Riverside County, are planning drives in the Morino Valley against predatory animals and squirrels. The dates for these drives have not yet been set, but will probably be early in the spring.—*Weekly News Letter*, Department of Agriculture, Jan. 26, 1921.

CONSERVATION IN OTHER STATES.

VIRGINIA HAS EFFECTIVE DOG LAW.

Virginia, oldest of states, is one of the youngest in the work of conservation. In recent years the state has become particularly famous because of its dog law, passed six years ago. During 1923, 17,000 roving, worthless dogs were killed in Virginia. In addition, over \$260,000 was collected in licenses and put to good use. The plan is now to put through a similar law in order to clean up the feral cats. An educational campaign is also in progress based on the motto, "You can teach a fellow a darn sight further than you can drive him." A sizeable magazine entitled *The Game and Fish Conservationist*, is published by the State Department of Game and Inland Fisheries.

PROTECTION IN NEW MEXICO.

The New Mexico Game Protective Association is disturbed over the fact that although provision was made to obtain a continuity of policy by having two commissioners hold over after each election, the custom has been started of the entire commission resigning on the election of a new governor.

The drift of opinion in New Mexico seems to be that reducing bag limits is more practicable and would do more good than shortening seasons. As a result, it is expected that some action along this line will be taken at the annual convention slated for March 13 and 14.

The association has offered a silver cup as a prize to the boy scout troop rendering the greatest service to wild life conservation.

LEAGUE OF OHIO SPORTSMEN ACTIVE.

Upset conditions prevail in the Game Department of Ohio, due to politics, according to a report made at the American Game Conference. A former executive officer has been forced to resign and

a "friend of the new governor, who admits that he is not a sportsman and knows nothing of fish and game work," has been appointed. As a consequence, the League of Ohio Sportsmen has become a strong centralized organization with offices in the capital city. Its slogan is "Save Outdoor Ohio." The league has already forced through several measures originally opposed by the governor and is now out for a governor who will support the conservation measures—a resident angler's license law and a divorce of the Fish and Game Division from the Department of Agriculture. The league plans a strong educational campaign to gain support for these ends.

MICHIGAN'S GAME REFUGES.

According to the 1921-1922 Biennial Report of the Michigan Conservation Commission, this state now has 77,621.41 acres set aside in game refuges. The most typical refuges have been secured by the purchase of patented land. Following the Pennsylvania plan, a single wire has been stretched around the refuge, forming the boundary line. Eight such refuges have been created by law. Enforcement is made difficult because of certain pieces of alienated land within the refuge impossible to secure. There are 163 private game dedications comprising 29,176.43 acres. These refuges, set aside for a term of years, allow no special privileges to the owners. They vary in size from five acres to 985 acres.

MINNESOTA WARDENS USE EDUCATIONAL METHODS.

On the face of the new badges issued to the game wardens appear two men—one a sportsman, and the other a game warden—who are shaking hands and exhibiting mutual understanding. This insignia was selected by the department to constantly remind its wardens of their

duties to the people of this state and exemplifies the spirit which should exist between sportsmen and wardens. The Game and Fish Department of Minnesota is trying to make their wardens friends and permanent assets to the community to which they are assigned. The department is placing men in these positions, who first of all can be relied upon to give efficient service and who intelligently understand wild life in all its various phases; men who place the conservation of Minnesota's wild life above everything else; men who will gladly cooperate with any individual or organization interested in our game and fish activities. It is instructing its wardens to teach the doctrine of conservation and the importance of it; to acquaint the visiting tourists with our laws in order to enable them to avoid embarrassing situations that might arise through ignorance of the same; to be of every service possible to the sportsmen of this state and to eliminate the game and fish law violators from our midst; to instruct them in the injustice they are working on our coming generations by their persistent violations.—J. P. Slattery, *Fins, Feathers and Fur*, No. 36, page 135.

BULLFROGS CONSIDERED GAME IN PENNSYLVANIA.

The distribution of 10,000 bullfrog tadpoles, furnished by the state hatchery at Pleasant Mount, Pa., was accomplished last fall by the Lehigh County (Pa.) Fish and Game Protective Association for planting in the streams and ponds of that county. Their allotment to applicants who were interested in the restoration of the sport of bullfrog hunting was conditioned upon the signing of an agreement

to properly plant and care for the embryo frogs and to release the association from any damage claims arising from "loss of sleep or peace of mind by reason of any croaking, noises or disturbances whatsoever that may now or hereafter emanate from any stream where said fullfrogs are planted."

LOUISIANA'S PUBLIC SHOOTING GROUND.

One of the first public shooting grounds in the United States was that set aside by the State of Louisiana at Passe a L'Ouvre. The area comprises 60,000 acres and is within easy reach of New Orleans. One hundred sportsmen may hunt at one time. All of the more desirable kinds of ducks winter here.

Rates have been fixed at approximately actual cost and are as follows: Boat service between Buras and the club, \$2.50 each way; meals and lodging, \$3 per day; guide, \$3 per day; duck boat and decoys, \$3 per day. It is possible to leave New Orleans Saturday morning, make a full morning's hunt on Sunday and return to New Orleans that evening.

RELATION OF BIRDS TO FORESTS WILL BE STUDIED IN LOUISIANA.

One of the few attempts to study the relation of birds to forests is being undertaken by the Great Southern Lumber Company of Louisiana with the cooperation of the State Division of Forestry. A specialist in forest birds has been employed and upon the completion of his report the company will build bird houses and distribute them over its reforested areas, hoping thus to attract birds and thus help control injurious tree insects.

REPORTS.

ARRESTS AND CONVICTIONS, JULY 1, 1923-DECEMBER 31, 1923.

Arrests	130
Convictions	131
Dismissed for Juvenile Court	3
Dismissed	4
Not guilty	1

Fines paid	\$7,150 00	Jail sentences served	150 days
Fines suspended	395 00	Jail sentences suspended	1,670 days
Total fines assessed	\$7,545 00	Total jail sentences	1,820 days

Violations for Which Arrests Were Made.

Deer—		Abalones—	
Meat out of season	21	Undersize	14
Killing spike bucks	7	Over limit	6
Killing does	7	Miscellaneous—	
Killing fawns	3	Undersize lobsters	16
Failure to retain head and hide	2	Game trespass	14
Quail—		No hunting license	12
Out of season	3	Shooting nongame birds	6
Trapping	2	Shooting protected game birds	2
Doves—		Shooting tree squirrels	2
Out of season	1	Shooting from auto	4
Over limit	2	Undersize clams	2
Ducks—		Sale spot fin croaker	1
Over limit	1	Sale corbina	1
Out of season	1	Sale trout	1
Night shooting	3	Undersize crabs	1
Shooting from power boat	1		

STATEMENT OF EXPENDITURES.

For the Period July 1, 1923, to December 31, 1923, of the Seventy-fifth Fiscal Year.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Commissioners			\$79 52		\$79 52
Executive offices	\$148 47	\$8,088 37	2,815 46	\$10 40	11,062 70
Printing	2,697 00				2,697 00
Research and publicity	14 74	2,100 00	474 89		2,589 63
Accident and death claims			75 42		75 42
Department totals	\$2,830 21	\$10,188 37	\$3,445 29	\$10 40	\$16,474 27
Commercial fishculture and conservation:					
Superintendence	\$176 70	\$3,795 00	\$1,881 02		\$5,352 72
Inspection and patrol	992 39	10,391 62	2,099 10	\$6 84	14,092 95
Research	331 43	6,114 79	874 62	\$6 61	7,357 45
Statistics	272 85	2,670 00	22 21		2,965 06
Propagation and distribution of salmon	3,001 74	6,772 18	462 51	15 42	10,251 85
Department totals	\$1,775 11	\$29,746 59	\$5,439 46	\$58 87	\$40,020 03
Sporting fishculture:					
Superintendence	\$25 56	\$5,007 25	\$1,199 58		\$6,172 39
Propagation and distribution of trout	13,615 58	27,011 32	4,228 86	\$26 41	44,882 17
Department totals	\$13,641 14	\$32,018 57	\$5,368 44	\$26 41	\$51,054 56
Patrol and law enforcement:					
Prosecutions and allowance			\$105 00		\$105 00
General patrol	\$634 46	\$57,540 80	39,684 62	\$4 16	97,864 04
Department totals	\$634 46	\$57,540 80	\$39,790 62	\$4 16	\$97,969 94
Fish and game conservation:					
Mountain lion hunting		\$750 00	\$458 78		\$1,208 78
Mountain lion bounties			1,860 00		1,860 00
State Fair exhibit	\$175 77	241 92	688 56		1,106 25
Department totals	\$175 77	\$991 92	\$3,007 34		\$4,175 03
License commissions			\$29,060 10		\$29,060 10
Tahoe camping ground	\$4 95	\$579 00	\$3 02		\$586 97
Grand totals	\$22,061 64	\$131,065 25	\$86,114 17	\$99 84	\$239,340 90

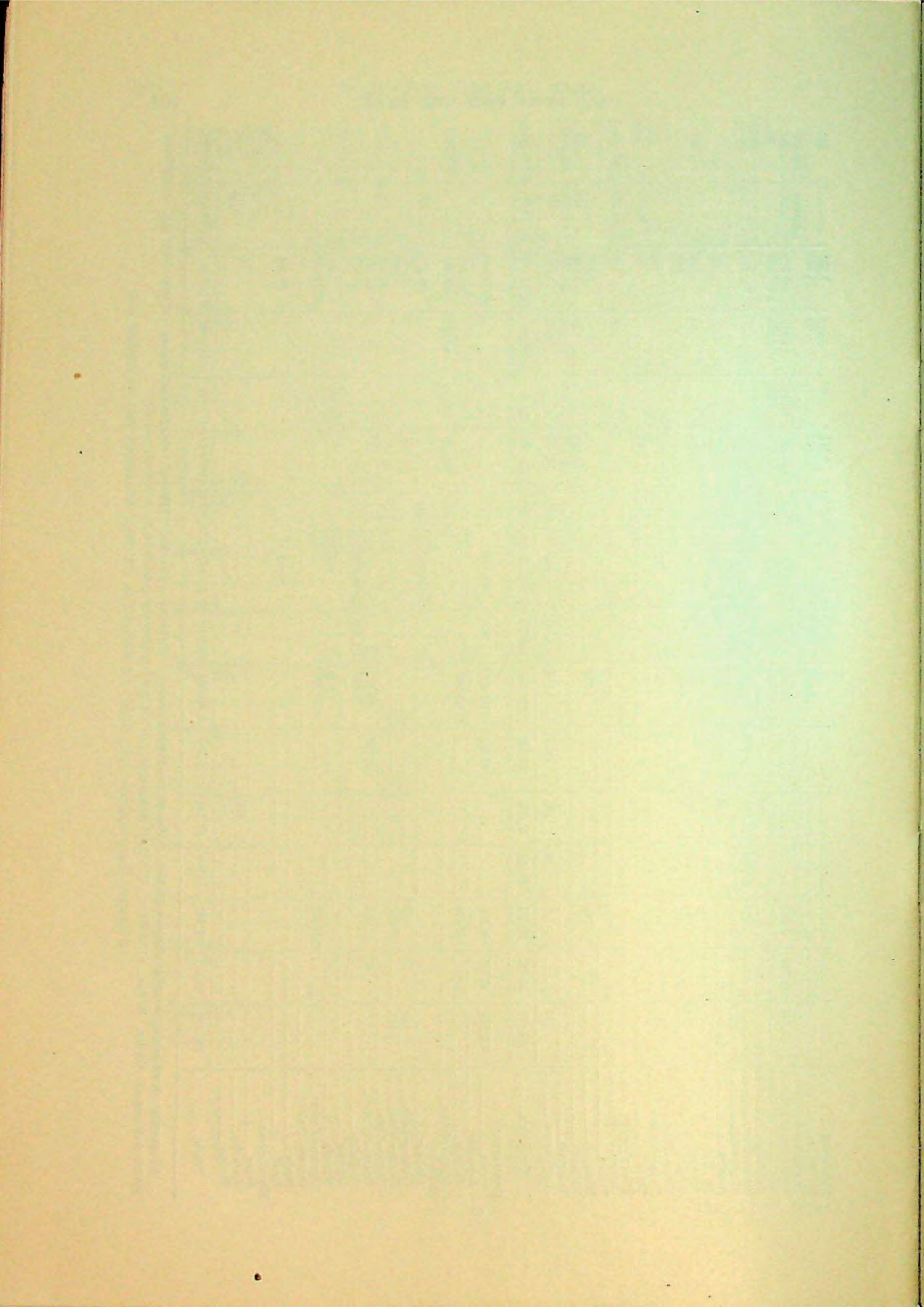
STATEMENT OF INCOME.

For the Period July 1, 1923, to December 31, 1923, of the Seventy-fifth Fiscal Year.

License sales:	Detail	Total
Angling	\$119,257 00	
Hunting	148,876 00	
Market fishermen's	18,560 00	
Wholesale fish packers'	1,685 00	
Trapping	1,777 00	
Game breeders'	40 00	
Fish breeders'	13 00	
Total license sales		\$259,610 00
Other income:		
Court fines	\$31,538 00	
Fish packers' tax	15,587 68	
Fish tag sales	3,059 83	
Game tag sales	10 47	
Sales of automobiles	375 00	
Sales of nets	27 00	
Sales of two cabins	70 00	
Crawfish inspection	10 00	
Total other income		51,583 96
Total income		\$311,193 96

81369	Sheepshead									76	3,641	42	3,491	7,250		442	
	Skates						34,410	1,382			932		60	36,784			
	Skipjack						39,266	2,283	4,141	4,056	109,637	98,872	7,512	285,475	4,523,926	2,300,875	
	Smelt	7,724	2,765	8,219			1,390,888	307,415	1,421	14,279	13,575	345	5,060	1,801,983	3,390	1,500	
	Sole													36		38	
	Splittail					36								104,231			
	Striped Bass			1,208	12,298	11,195	77,033	2,339	98								
	Stingaree													69			
	Suckers					69											
	Surf Fish										1,806		150	1,956		565	
	Swordfish													7,402			
	Tomcod							3,927	3,475								
	Trout—Farm													236			
	Trout—Steelhead	236									68			68	70,457		
	Tuna																
	Tuna—Bluefin												280	280	5,804,623	2,787,102	
	Tuna—Yellowfin													12			
	Turbot			12										1,768			
	Whitebait			165			1,603				14,460		676	15,136	478	2,353	
	Whitefish									911	522,491	905	230,000	754,397	136,354	555,248	
	Yellowtail									528	10,925		1,070	25,177	586	4,310	
	Miscellaneous	10			10	163	224	3,104	8,594	549							
	Total Fish	295,466	13,783	22,571	30,824	81,058	137,128	2,616,427	869,843	37,923,681	160,769	12,475,473	154,435	1,000,047	55,781,505	11,719,610	6,321,445
	Crustaceans:														11422,280		
	Crabs	127,504	12,688	14,800			13,432	1381,456	1456	101,944							
	Ecrevisse														269,767		
	Shrimps			146,420				123,347							258,994		274,731
	Spiny Lobsters									49,462	103,820	20,561	85,151				
	Mollusks:									358,521	1,703				360,224	6,420	
	Abalones														1,246		
	Clams—Cockle	140	20	267							819				8,989		
	Clams—Mixed	5,411		3,578											56,919		
	Clams—Pismo														66,127		
	Clams—Softshell		40	21,600			31,757	12,730							24,193		
	Cuttlefish							1,456	11,809	10,928							
	Limpets														7,503		
	Mussels							4,928	375			2,200			1227,135		
	Oysters—Eastern			101,928				125,207									
	Oysters—Native																
	Snails														72,703		
	Squid								72,703								
	Miscellaneous:																
	Frogs														96		
	Terrapins					190										620	
	Turtles																
	Totals	328,521	16,531	301,164	30,824	81,154	172,317	3,265,551	882,108	38,368,152	268,853	12,580,112	177,196	1,085,198	57,557,681	11,726,650	6,596,676

All amounts shown in pounds, unless otherwise specified. Albacore and skipjack cleaned. ¹1,146 doz. ¹112 doz. ²200 doz. 463,310 shell oysters. ⁴1 doz. ¹143 doz. ¹15,894 doz.
⁸569,125 shell oysters. ⁹19 doz. ¹⁰1 doz. ¹¹17,595 doz. ¹²1,032,435 shell oysters.



PATROL SERVICE.

SAN FRANCISCO DIVISION.

G. H. Anderson, Commissioner in Charge. J. S. Hunter, Assistant Executive Officer.
Phone Sutter 6100.

W. H. Armstrong	Vallejo	Henry Lencioni	Santa Rosa
Earl P. Barnes	Eureka	Albert Mack	San Francisco
Theo. M. Benson	Fortuna	B. H. Miller	Ukiah
O. P. Brownlow	Porterville	E. V. Moody	Santa Cruz
F. A. Bullard	Dunlap	W. J. Moore	Napa
J. L. Bundock	Oakland	J. E. Newsome	Newman
J. Burke	Colma	Chas. R. Perkins	Fort Bragg
M. S. Clark	San Francisco	H. I. Pritchard	Atwater
J. H. Hellard	Laytonville	E. W. Smalley	Hanford
J. H. Hill	Watsonville	H. E. Foster	Launch "Quinnat," S. F.
I. L. Koppel	San Jose	Chas. Bouton	Launch "Quinnat," S. F.

SACRAMENTO DIVISION.

F. M. Newbert, Commissioner in Charge.
Geo. Neale, Executive Officer.
Forum Building, Sacramento.
Phone Main 4300.

T. W. Birmingham	Red Bluff	Roy Ludlum	Sacramento
S. J. Carpenter	Maxwell	R. C. O'Connor	Grass Valley
Euell Gray	Placerville	D. E. Roberts	Murphys
W. J. Green	Sacramento	J. Sanders	Truckee
G. O. Laws	Weaverville	R. L. Sinkey	Woodland

LOS ANGELES DIVISION.

M. J. Connell, Commissioner in Charge.
Edwin L. Hedderly, Assistant.
Pacific Finance Building, Los Angeles.
Phone: Metropolitan, 3621.

H. J. Abels	Santa Maria	E. H. Ober	Big Pine
H. D. Becker	San Luis Obispo	E. D. Ricketts	Los Angeles
J. H. Gyger	Perris	Webb Toms	San Diego
W. C. Malone	San Bernardino		

1921 ABSTRACT SPORTING FISH AND GAME LAWS 1923

OPEN SEASON INCLUDES BOTH DATES GIVEN.

SPECIES	DISTRICT	OPEN SEASON	BAG LIMITS, POSSESSION LIMITS, ETC.
DEER	1-1½-4½ 23-24-25-26 2-2½-3 4	Sept. 1-Oct. 15 Aug. 1-Sept. 14 Sept. 16-Oct. 15 Nov. 1-Jan. 15	Two Bucks per season. No Does, Fawns, or Spike Bucks. No sale of venison or skins. 15 per day, 30 per week Closed until Sept. 1, 1925. Killing Elk a felony. \$1,000 fine for Sea Otter.
RABBITS (Cottontail and Bush)	ALL	No Open Season	
TREE SQUIRRELS	ALL	No Open Season	
ELK, ANTELOPE, MOUNTAIN SHEEP	ALL	No Open Season	
SEA OTTER, BEAVER	ALL	Oct. 15-Feb. 28	
BEAR, FUR ANIMALS	ALL		
DUCKS, GEESE, JACKSNIPES, MUD HENS	ALL	Oct. 1-Jan. 15	25 per day, except Geese, 8 per day. For weekly limit see law.
RAIL, WOODDUCK, PIGEONS, SHORE BIRDS	ALL	No Open Season	
QUAIL (Valley, Desert, Mountain)	ALL Except 1½ 1½	Nov. 1-Jan. 15 Oct. 15-Dec. 15	Valley, Desert, 15 per day. 30 per week. Mountain, 10 per day. 20 per week.
SAGE HEN	ALL Except 4½ 4½	Aug. 1-Sept. 15 No Open Season	4 per day. 8 per week.
DOVE	ALL	Sept. 1-Oct. 31	15 per day. 30 per week.
GROUSE	ALL	Sept. 15-Oct. 14	4 per day. 8 per week.
TROUT (Except Golden), WHITE FISH	1-1½-2-3-4-4½ Lake Almanor	May 1-Oct. 31	See Game Law Abstract.
	2½	July 1-Feb. 14	
	23-24-25	May 30-Oct. 31	
	Lakes, Etc.*	Aug. 1-Oct. 31	
	1½ Winter	Nov. 1-Dec. 31	
	2-3-10 Tidewater	Dec. 15-Feb. 28	
	2-2½-10 Spear	April 1-Jan. 31	
GOLDEN TROUT	ALL	June 30-Oct. 1	20 per day. None under 5 in.
BLACK BASS	ALL, Except 4e, Clear Lake	May 1-Nov. 30	25 per day. None under 7 in. No sale.
	4e, Clear Lake	No Closed Season	
SACRAMENTO PERCH, SUNFISH, CRAPPIE	ALL	May 1-Nov. 30	25 per day.
STRIPED BASS, SHAD	ALL	No Closed Season	See Game Abstract.
SALMON	ALL Except 15	No Closed Season	See Game Abstract.
	15	April 1-Aug. 31	
CRABS	ALL	Nov. 15-July 30	See Game Abstract.
ABALONES	ALL	Mar. 16-Jan. 14	See Game Abstract.
PISMO CLAMS	17	Sept. 1-April 30	See Game Abstract.
SPINY LOBSTER	ALL	Oct. 15-Feb. 28	See Game Abstract.

*Special provision; see Game Abstract.

HUNTING LICENSES

License Year from July 1 to June 30

Residents, \$1.00. Non-residents, \$10.00. Certain
Aliens, \$10.00. Other Aliens, \$25.00.

ANGLING LICENSES

License Year from January 1 to December 31

Residents, \$1.00. Non-Residents, \$3.00. Aliens,
\$3.00.

TRAPPING LICENSES

License Year from July 1 to June 30

Citizens, \$1.00. Aliens, \$2.00.